HONEYWELL

1858

Maintenance Training

Workbook

Honeywell

TEST INSTRUMENTS DIVISION • P. O. BOX 5227 • DENVER, COLORADO • 80217

HONEYWELL
1858
Maintenance Training
Workbook

I. Product Information
II. Simplified Drawings
III. Calibration Procedure
IV. Schematics
V. Notes

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_07130

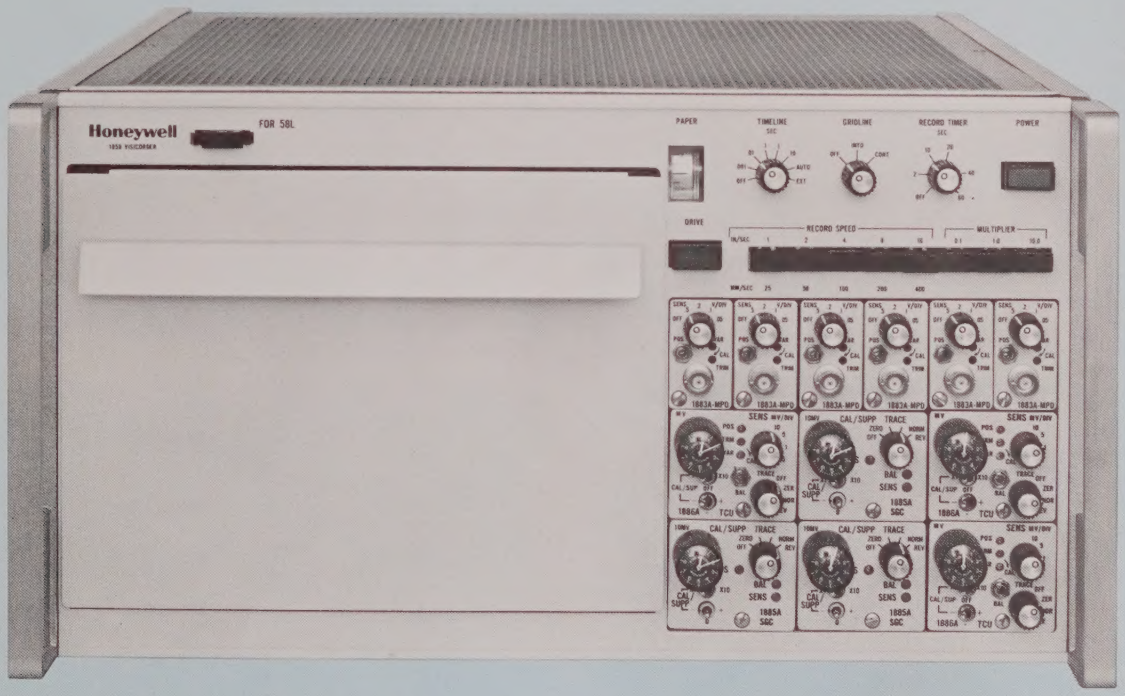
Honeywell

Oscillographic Recorders

VISICORDER MODEL 1858

PRODUCT INFORMATION

Fiber-optic CRT recorder complete with self-contained signal conditioning...a compact 18 channel Graphic Data Acquisition System. Expandable to 32 channels.



Underwriters Laboratories Listed

Outstanding Features

- 18 channel system in single 8¾ inch (22.3 cm) high package
- 32 channel system in a 14 inch (35.6 cm) high package
- Front panel plug-in signal conditioning modules
- Inertialess recording — no moving elements, no styli
- DC — 5 kHz response at up to 7.2 inch (18.3 cm) trace amplitude
- 100 μV-300V input sensitivity, to 300V common mode
- No trace overshoot
- Sharp static traces without high frequency "wipe-out"
- Direct writing, 8 inch (20 cm) record width, 200 ft (61 m) record length
- 5-interval timing system with accentuated tenth line and 0.1% accuracy
- Time-interval marker
- Auto-linearized for increased data accuracy
- Numbered trace identification
- Wide-range, dc-servo drive system
- 0.1 to 120 inch/sec (2.5 to 3000 mm/sec) record speeds
- 42 discrete record speeds via binary addition push-buttons
- Remote drive and speed control
- Internal record takeup
- Automatic record-length control
- 120/240V, 50-400 Hz power, switch selectable
- Lightweight, low power consumption
- Rack or table mounting
- Wide selection of signal-conditioning modules available
- Easy to use as an oscilloscope — just add signal input connections

Test Instruments Division ▪ In U.S.A.: P.O. Box 5227, Denver, CO 80217 ▪ In Canada: 740 Ellesmere Road, Scarborough 733, Ontario

Product Description

The Model 1858 Graphic Data Acquisition System is not just another oscillograph — it offers a totally new concept in acquiring and recording analog data. State-of-the-art design, combined with reduced complexity and integrated circuitry, makes the Model 1858 the first self-contained, yet compact, graphic data acquisition system with a selection of up to 18 recording channels. When combined with the accessory Model 1870 housing, the channel output can be increased to 32. In addition to being versatile and easy to use, the system is exceptionally accurate and reliable.

In a lightweight package only 8¾ inches (22.3 cm) high, the Model 1858 outperforms other systems requiring a full rack of equipment. This means that the system can be used with laboratory accuracy either in the field or in a fixed location. Adaptability to different ac line voltages and insensitivity to line frequency variations allow world-wide usage. Or, by using an inexpensive power inverter, the system may be battery operated.

Records that are relatively insensitive to normal room light are produced without inks, powders, styli, electrostatic charges, liquids, electrical arcs or chemical vapors. Ultraviolet light is generated by a cathode-ray tube and directed through a special fiber-optic faceplate onto photosensitive direct print paper. Thus, recordings are produced immediately without the need for inconvenient and time-consuming wet processing or toner application.

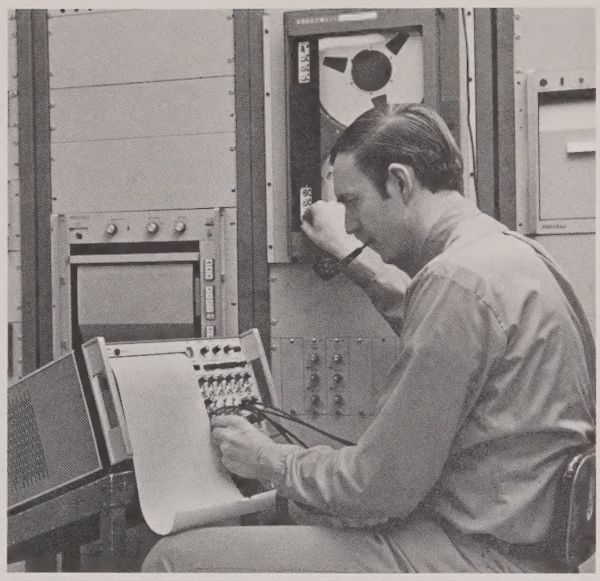
Front panel openings on the 1858 accept up to 18 individual signal-conditioning modules. A family of these plug-in modules is available to cover a wide variety of applications. Among these are: high-, low- and medium-gain differential amplifiers, a strain-gage control, a thermocouple control, a frequency to voltage converter, and a module to simultaneously condition signals for the 1858 and instrumentation tape recorders. These signal conditioners allow recording within the dc to 5 kHz range and accept input signals from 100 μV to 300V. Calibrations in millivolts and volts-per-division make the Model 1858 as easy to operate as an oscilloscope. Also, since the plug-in signal conditioning modules do not have to supply power to drive pens or galvanometers, they have been miniaturized using state-of-the-art integrated circuits.

All plug-in modules contain an analog-voltage-to-time converter. The converter produces a pulse with a duration proportional to the amplitude of the input signal. These pulses unblank the CRT which is swept at a fixed rate of 50 kHz. To avoid a dotted trace presentation at high frequencies, a uniquely designed memory circuit connects the unblanked samples to yield a continuous trace.

To assist in measuring the amplitude and time of recorded signals in calibrated increments, the Model 1858 places longitudinal amplitude reference lines and transverse timelines on the record. Also available, as an option, is a trace numbering and identification feature. This feature identifies the signals and prints the corresponding channel numbers on the edge of the paper.

A wide range (1200:1) dc servo system allows a selection of paper speeds from 0.1 to 120 inch/sec (2.5 to 3000 mm/sec) in 42 discrete steps. As a further convenience in handling the recording paper, a built-in record takeup unit is offered as an option.

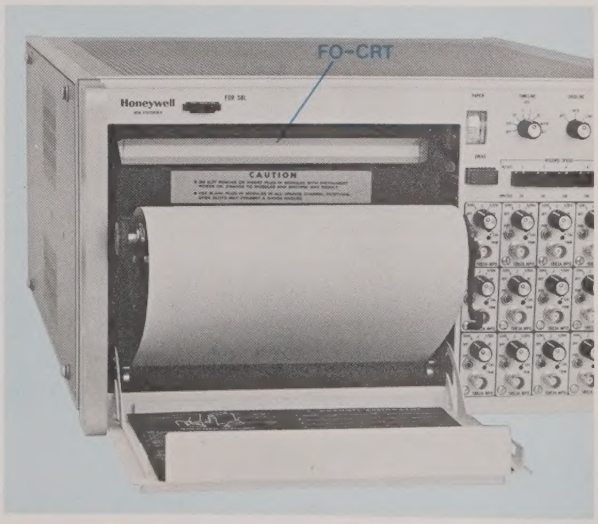
All operator controls are on the front panel. These include a power switch, speed selector pushbuttons, record drive switch, timing interval selector, gridline selector and automatic record timer. Indicators are also provided for power on, drive on and paper supply.



Standard Features

Electronic Housing

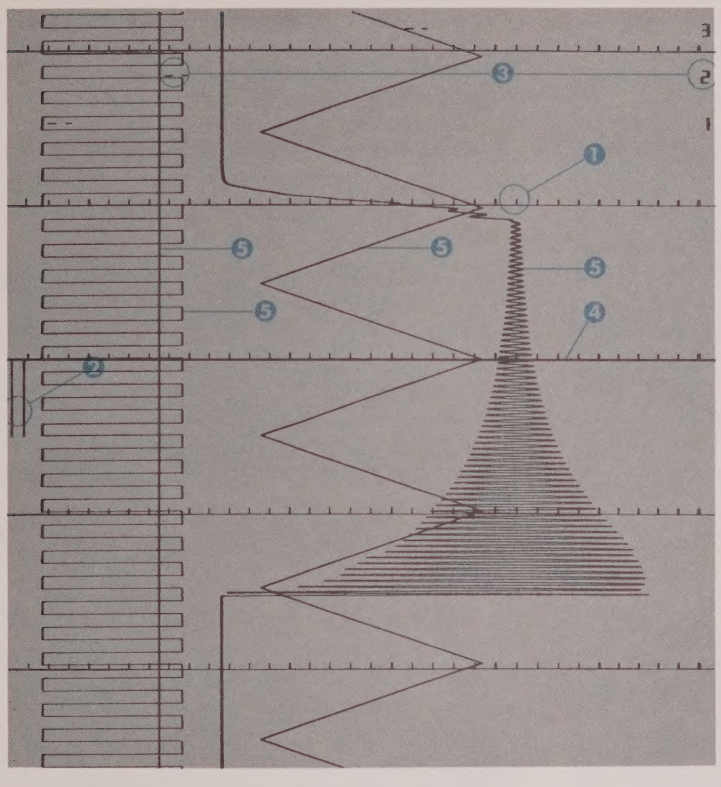
A single, 8¾ inch (22.3 cm) high housing encloses a fiber-optic, cathode-ray tube (FO-CRT), power supplies, control circuits, reference line circuits, and record drive servo. The housing also accepts up to 18 individual plug-in signal-conditioning modules.



Fiber-optic Cathode-ray Tube

The specially designed FO-CRT faceplate consists of about 10 million glass fibers — each only a few microns in diameter — fused together within a 0.2 by 8 inch (5 by 200 mm) area. These fibers provide efficient transfer of ultraviolet radiations from the phosphor inside the faceplate to the photosensitive paper. This permits extremely fast writing speeds and excellent trace resolution.

Since the recording paper is in intimate contact with the faceplate, additional optical elements are not required. Intensity and focus are factory preset and, since adjustments are rarely required, controls are not on the front panel. To prolong phosphor life, the recording area is gradually moved in both axes. This movement is so slow that it in no way detracts from the accuracy or readability of the recording.



1. **Interrupted Gridline**
2. **Time Interval Marker**
3. **Numbered Trace Identification**
4. **Timelines**
5. **Data Traces**

Note: Graph as shown is 55% of original size.

Gridlines

To assist in measuring signal amplitudes in calibrated increments, the Model 1858 can place longitudinal lines each 0.2 inch (5 mm) across the paper. The lines are accentuated at 1-inch (25 mm) intervals and appear across 7.2 inch (18.3 cm) of the record.

The gridlines may be continuous or interrupted, as selected via a front panel switch. The switch also allows the gridlines to be turned off for applications where signal levels are not important.

Interrupted lines appear for approximately 1/16 inch (1.6 mm) following each timeline, retaining amplitude references without cluttering the record. The interrupted gridline feature is operable only when the timing line option is included and is in use.

Record Drive

Recording paper is driven over a 1200:1 speed range by a servo system consisting of a dc drive motor, tachometer generator and associated electronics — totally eliminating gears and clutches. In addition to providing a wider selection of paper speeds than mechanical gear systems, the servo drive system is quiet, reliable, easily maintained and allows increased flexibility for remote or computer control.

Speed selection is controlled from the front panel by five pushbuttons of 1, 2, 4, 8 and 16 inch/sec (25, 50, 100, 200 and 400 mm/sec) and three multiplier pushbuttons of x0.1, x1 and x10. By depressing the switches in binary addition, 42 discrete speeds can be selected.

a. 0.1 to 1.6 inch/sec in 0.1 inch/sec increments (2.5 to 40 mm/sec in 2.5 mm/sec increments)
b. 1 to 16 inch/sec in 1 inch/sec increments (25 to 400 mm/sec in 25 mm/sec increments)
c. 10 to 120 inch/sec in 10 inch/sec increments (250 to 3000 mm/sec in 250 mm/sec increments)

Remote control of drive on-off and CRT unblanking is provided by a rear panel BNC connector. The LOCAL/REMOTE selector switch on the rear panel locks out actuation by other than the selected mode. Remote actuation is TTL compatible or by a single pole, single throw switch closure.

By applying 0.008 to 10V to a rear panel connector, the entire speed range of 0.1 to 120 inch/sec (2.5 to 3000 mm/sec) can be remotely programmed in continuously variable or discrete steps.

Automatic Record Length

A front-panel switch allows manual or automatic control of recording time. When the switch is set to off, recording time is manually controlled by the drive switch. For automatic control, the record timing switch is continuously adjustable from 1 to 60 seconds. By setting the timer and then depressing the drive switch, either local or remote, the record is driven for the selected amount of time and stopped automatically. The drive switch must be released and pressed again to initiate another recording cycle.

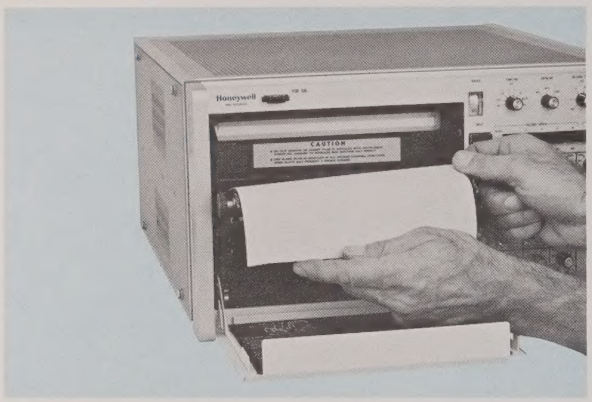
Underwriters Laboratories Inc. Listed

The Model 1858 Visicorder oscillograph, in combination with the signal conditioning modules, are Underwriters Laboratories Inc. listed under both UL 544, Listed Medical Equipment and UL 1244, Listed Electrical Measuring Equipment. When ordering, the user must state his choice of either Medical or Industrial listing since differences exist in construction and panel marking. Most modifications and accessories are also U.L. accepted. See page 21 for ordering information and modification/accessory U.L. acceptability.

The Underwriters Laboratories Inc. listing applies to standard units only, and only when used with U.L. accepted accessories. Units specially modified will be built

to the UL configuration specified on the order but the "UL Listed" markings will be omitted where such modifications would violate the UL listing.

Paper Loading



Recording paper can be loaded in seconds, without threading. Simply pull the platen forward, insert the supply spindle in the new roll, drop the roll into the cradle and push the platen back into position. A paper supply meter on the front panel indicates the approximate amount of paper remaining.

Ambient Light Cover

A hinged door protects the photosensitive paper from ambient light and functions with or without the record takeup option.

Recording Paper

Records are relatively insensitive to normal room light and remain stable indefinitely when stored. Recording papers are available from Honeywell, as well as several manufacturers of photosensitive materials. When copying is required for inclusion in technical reports, some of these materials are available for reproduction by office copying equipment, photostating, etc., while others are available for wet chemical processing. Paper improvements are frequent, so contact your Honeywell representative for the latest information.

Optional Features (Factory Installed Only)

Timelines

The timeline feature can be operated manually, automatically or externally, and it includes time interval markers.

For manual control, a front panel switch produces ±0.1% accurate timelines across the paper at intervals of 0.001, 0.01, 0.1, 1 or 10 seconds. Each tenth line is accentuated to facilitate record analysis. The timelines also can be slaved to external signals at rates up to 1000/sec.

In the auto mode, timelines are automatically printed at predetermined intervals, as determined by the recording speed selected:

Paper Speed		Timing Interval
Inch/sec	mm/sec	(sec)
0.1 to 0.7	2.5 to 17.5	1
0.8 to 7	20 to 175	0.1
8 to 70	200 to 1750	0.01
80 to 120	2000 to 3000	0.001

Another benefit of the timeline option is automatic time marking. One or more coded marks are placed perpendicular to each accentuated timeline, near the left edge of the paper, as shown in the sample recording.

In this manner, the timeline interval and record travel speed at which a recording was made can be determined without having to annotate the record. The timing marks are disabled when the timelines are externally triggered. The time mark coding is:

Mark	Seconds
none	0.001
1	0.01
2	0.1
3	1
4	10

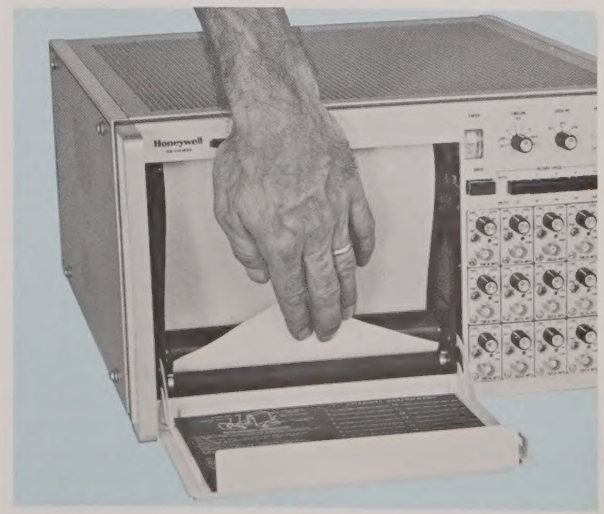
Numbered Trace Identification

For positive identification of each data channel, this option prints the channel number on the right edge of the paper and places two dash marks, 1/16 inch (1.6 mm) to the right of the corresponding data trace (see sample record). Channels are identified in sequence approximately every 0.5 inch (12.5 mm), regardless of paper speed.

When a recording channel is not equipped with a conditioning module, no identification mark or number is printed. Dual signal conditioning modules require two plug-in slots and are, therefore, assigned two channel numbers. In this case, only the lower of the two channel numbers is printed.

Internal Record Takeup

This option consists of a mechanism that internally spools up records of any length to 200 ft (61 m). The option accommodates the full range of paper speeds and eliminates the need for inconvenient accessory devices. No additional motors or clutches are required because the takeup spool is driven by a toothed belt connected to the paper drive servo.



Depending on the method of loading the paper, records can be either taken up or fed out of the Model 1858. Loading the takeup spindle is simple, and no adhesive tape or threading is necessary.

After loading the supply as previously described, lay the takeup spindle against the paper, push the spindle into the slots provided, pull the paper snugly against the takeup spindle and start the paper around the spindle with the drive system operating at a speed of 0.2 inch/sec (5 mm/sec).

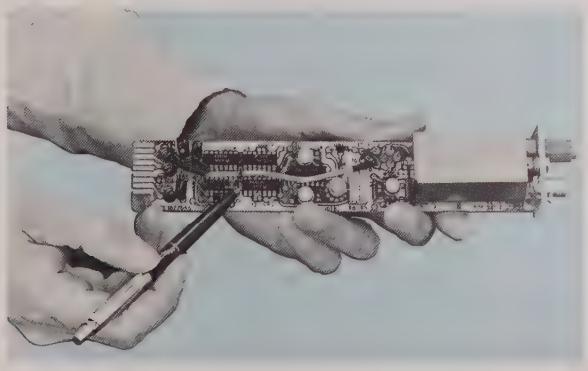
Removal of a full or partial roll is equally convenient: simply tear the paper across its width, push the spooled paper backward and upward in the guides and withdraw the roll. The takeup spindle is then pushed out from the spooled up paper and may be used immediately for succeeding records.

Signal Conditioning Modules

A variety of plug-in modules are available to accept input signals from 100 μV to 200V per major division from voltage and transducer sources with common mode voltages to 300V. All operating power is drawn from supplies within the electronic housing. As a result, the modules are compact — up to 18 single-width, 9 dual-width, or a combination of both can be accommodated in the basic Model 1858 — up to 32 single-width, 16 dual-width with the add-on Model 1870 housing.

Sensitivity calibrations are in volts/division (V/DIV) rather than gain to simplify operation. Each module has a switch to turn its display on or off without disturbing the established baseline position. And, a position control allows the baseline of the trace to be placed anywhere across the entire width of the paper. Each module is capable of producing a recording at any amplitude up to 7.2 inch (18.3 cm) and at frequencies from dc to 5 kHz.

Signal input connections are made through five-pin MS-type connectors on the Model 1858 rear panel. However, some modules offer a choice of either rear-panel or front-panel (BNC) input via a jumper-pin change within the module.



In addition to providing signal amplification, some modules provide gage excitation, suppression and calibration for applications such as strain gage and temperature measurement. Although the modules are completely self-contained for most measuring needs, appropriate preconditioning is required for certain transducers, such as piezoelectric devices. Complete specifications for all of the signal conditioning modules start on page 10.

Additional Channel Capacity

The Model 1870 add-on 14 channel housing, described and shown in the right-hand column of page 6, allows the Model 1858 channel capacity to be extended to 32 channels. Adding the housing requires that the Model 1858 be provided with interface connectors, available as a factory-installed option. Retrofit kits are also available for units not originally equipped with this option.

Remote Control

Full remote control of timelines, gridlines, and any or all record drive speeds and drive on/off, including blanking control of the recording beam, is available on special order. Remote control may be actuated by external-switch closures or computer-logic commands. For specific information for your particular application, consult your nearest Honeywell representative or request D-2429.

Accessories

Rack Mounting Kit

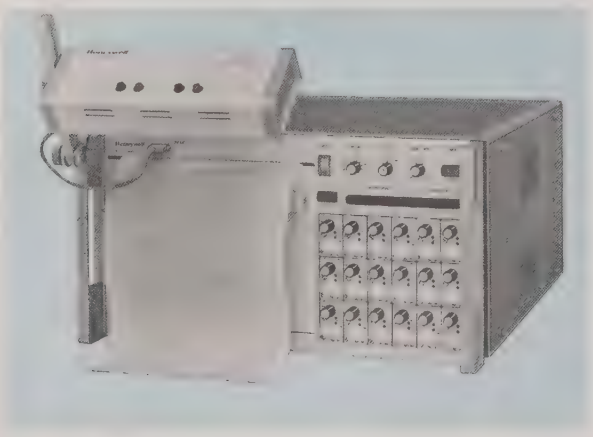
The Model 1858 is designed for both table and rack mounting. For rack mounting, an accessory kit is available. The kit consists of slide rails, front trim strips and mounting hardware. The slide rails fit into 25 inch (63.5 cm) deep standard EIA racks. Only 8¾ inches (22.3 cm) panel height is required to mount the Model 1858, including all options and accessories; 14 inches (35.6 cm) with the 1870 housing.

Latensifier Lamp Assembly

Printout-type recording paper used in the 1858 is exposed by ultraviolet light forming a latent image on the recording paper. The latent image appears as a trace when later exposed to light in the visible spectrum — ideally, fluorescent. The rapidity with which the trace will appear is proportional to the intensity of this secondary exposure.

To aid in the forming of the latent image, a process commonly called "latensification," an adjustable latensifier lamp assembly is available for mounting on the front of the 1858. This assembly has cool-white fluorescent lamps, controlled by pushbutton switches, for normal record latensification at the slower record travel speeds. The lamps accelerate the latensification for the shortest possible trace appearance time.

Record qualities, such as contrast and writing speed, are degraded by rapid latensification. However, the user can readily select the best position and lamp combination for his particular needs.

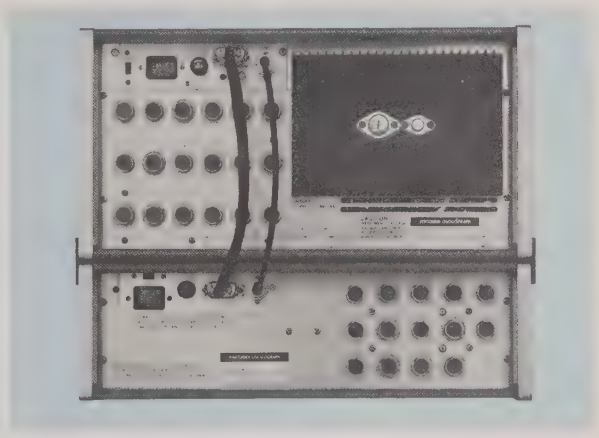


Writing Platen

Where it is desired to make pencil annotations on the record, or to observe the data before a record is spooled onto the internal takeup, an accessory writing platen is available. The platen may be used either in the spill-out or take-up mode. The hinged front cover door must be left open when this accessory is used. The platen is attached to the 1858 after the paper is loaded, but before the takeup is engaged, by simply pushing it into place where it is retained by two knurled thumb-screws. Installation time is only a few seconds.

Amplifier Housing Model 1870

The Model 1870 Amplifier Housing allows the Model 1858 Visicorder oscillograph to record up to 32 data channels simultaneously. The 1870 consists of a single housing, mounted beneath the Model 1858, that will accept 14 single-width, 7 dual-width (or combinations) of the 1880 series signal conditioning modules for the Model 1858. The housing contains its own power supplies and therefore does not increase the load on those of the Model 1858. Interface between the 1870 housing and the 1858 is via two rear-panel connectors and cables.



To use the 1870 housing with the Model 1858, the 1858 must have both the "9" (trace identifier) and the "H" (housing) options in its model code (e.g., 1858-T7**9H**). Otherwise, in addition to the 1870 housing, a retrofit kit for the Model 1858 is required. Kits are available to allow field retrofit of the Model 1858 to accommodate the 1870 housing.

Like the Model 1858, the 1870 housing is supplied for table mounting. Accessory slide kits are available for mounting in standard EIA racks. Although the 1858 and the 1870 are individual units, the 1870 must be mounted below, and mechanically connected to the 1858 for both physical and electrical (noninductive) grounding reasons. The 1870 housing is supplied with the appropriate hardware for this purpose.

The numbered trace identifier system of the Model 1858 has been redesigned to accommodate the full 32-channel capability of the 1858-1870 combination, and to provide the interface between the 1870 and the 1858. Jumper pins on the trace identifier circuit card restrict the capability to 18 channels when the 1870 is not used. A 32-channel trace numbering circuit card is supplied with the retrofit kits for earlier Model 1858's, and for later Model 1858's that do not have the trace identifier option installed.

Data signal inputs are on the rear panel of the 1870, as they are on the 1858, and the connectors and wiring configurations are identical to those of the Model 1858.

The 1870 housing requires no operating controls other than the power on-off switch. All recording functions are provided by the Model 1858, with the appropriate signals (video, retrace, line, clock, ramp, count, control) between the 1870 and the 1858 accommodated by the two interface cables at the rear of both units.

All performance characteristics of the Model 1858 and the 1880 series signal conditioning modules are retained when operated with the 1870 housing. Wattage is 25W with no modules installed.

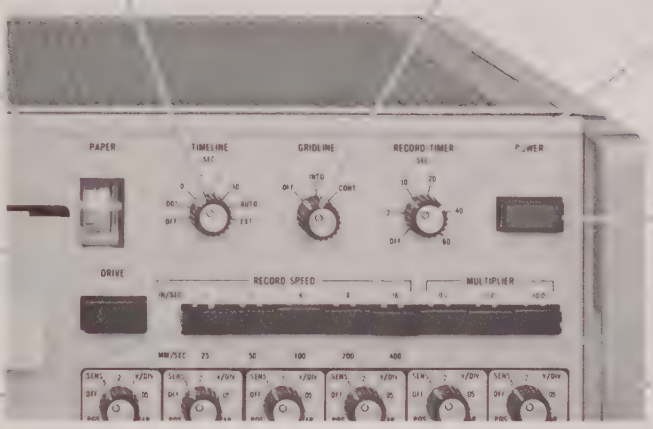
Controls and Indicators

TIMELINE (optional)
Eight position rotary switch selects timeline intervals of .001, .01, .1, 1 and 10 seconds, plus off, automatic and external synchronization positions.

GRIDLINE
Three position rotary switch allows selection of gridlines off, interrupted, or continuous.

PAPER
Indicator shows approximate amount of recording paper remaining.

RECORD TIMER
Rotary control selects manual or automatic record length (time); automatic is 1 to 60 seconds.



DRIVE
Latching pushbutton switch energizes servo record drive system. Unblanks CRT for recording; glows green when on.

POWER
Pushbutton switch turns power on for standby; glows red when on.

RECORD SPEED
Five additive pushbutton switches select 1, 2, 4, 8 or 16 inch/sec (25, 50, 100, 200, 400 mm/sec) in steps of 1 inch (25 mm) per sec.

MULTIPLIER
Three pushbutton switches multiply the selected record speed by 0.1, 1.0 or 10.0 (120 inch/sec) (3000 mm/sec) max.

CONTROLS ON REAR PANEL

LINE VOLTAGE
Slide switch adapts system to 120 or 240V, 50-400 Hz power.

REMOTE DRIVE
Toggle switch selects local or remote record drive.

Specifications

General

Recording System ..... Single fiber-optic, cathode-ray tube in direct contact with direct-print photographic paper produces all data traces, timelines, gridlines and trace identification recordings. Single 8¾ inch (22.3 cm) high cabinet houses paper supply, paper takeup, drive system, fiber-optic cathode-ray tube, power supplies and all associated electronics, as well as openings for signal conditioning modules for up to 18 data channels.

Recording Medium ..... Direct print photographic oscillograph recording paper, spec 2 [spooled emulsion side out on 1⅛ inch (28.6 mm) ID core].

Record Width ..... 8 inch (200 mm)

Record Capacity ..... 3¼ inch (82.6 mm) max roll diameter; 100 ft (30 m) standard base, 200 ft (61 m) extra thin base.

Recording Channels ..... 18 max single-width modules, 9 max dual-width modules, or combinations.

Operating Specifications

(All specifications apply after 30 minute warmup.)
Power Required:

Voltage ..... 107/127V, 50-400 Hz or 214/254V, 50-400 Hz by rear switch selection. Transformer taps permit operation down to 100 or 200V, 50-400 Hz.

Wattage ..... 100-350, depending on options, paper speed and number of channels installed. See table on page 9 for typical values.

Frequency Response ..... DC-5 kHz sinewave, 15 kHz squarewave; except as otherwise limited by signal conditioning module selected.

Input Data Sampling Rate..... Approximately 50 kHz (sweep time 15 μsec; flyback time 5 μsec).

Accuracy
Linearity
Sensitivity
Drift
Noise
Common Mode Voltage
Common Mode Rejection
Overload Recovery
Filtering
Crosstalk
..... See signal-conditioning module specification sheets

Trace Dimensions ..... Max 0.012 inch (0.3 mm) dynamic, 0.020 inch (0.5 mm) static (plus applicable signal conditioning noise spec).

Trace Amplitude ..... Max 7.2 inch (18.3 cm) pk-pk or single deflection throughout dc-5 kHz frequency range.

Trace Positioning ..... Controls on signal conditioning modules permit electrical positioning of any channel at any point across the record.

Trace Off ..... Switch on signal conditioning modules permits any channel to be turned off the record. When turned on, trace restores to previously established base position.

Phosphor Burn Protection..... Area of horizontal sweep is continuously moved up and down CRT face while both gridlines and data are continuously moved horizontally approximately 0.18 inch (4.5 mm) to maximize phosphor life. Vertical period is approximately 450 sec, horizontal period is approximately

2000 sec. Beam is blanked while drive switch is off. Operator does not have access to intensity or sweep rate controls.

Tube Life (rated) ..... CRT gun, 5000 hr (power-on); phosphor, 2500 hr (drive switch on).

Recording Intensity Control ..... Internal control for initial setting and periodic maintenance. No change of intensity required over full writing or paper speed range. Automatic intensity reduction at paper speeds <1 inch/sec (<25 mm/sec).

Gridlines

Selection ..... Front panel control allows gridlines (amplitude reference) to be turned off, on intermittently or on continuously. Intermittent lines appear for approximately 1/16 inch (1.6 mm) adjacent and perpendicular to each timeline.

Spacing ..... Nominal 0.2 inch (5 mm), each fifth line (1 inch, 25 mm) accentuated. Gridline spacing may vary slightly to compensate for nonlinearity of CRT.

Accuracy ..... Within ±0.5% full scale relative to data. Gridlines vary in spacing to compensate for nonlinearity of CRT. Combined accuracy of gridlines and data traces, relative to each other, will be within the accuracy and linearity specifications of that listed for the signal conditioning module used.

Temperature Coefficient of Spacing ..... <±0.075% /°C

Line Width ..... Minor lines 0.010 inch (0.25 mm) max; accentuated lines 0.020 inch (0.5 mm) max.

Record Drive System

Type ..... Wide range dc servo with 1200:1 speed range. No gears or clutches.

Speed Selection ..... Five front panel pushbutton speed selector switches of 1, 2, 4, 8, 16 inch/sec (25, 50, 100, 200, 400 mm/sec) plus three multiplier pushbutton switches of X0.1, X1, X10 give 42 discrete speed steps. Speeds of 1, 2, 4, 8 inch/sec (25, 50, 100, 200 mm/sec) may be engaged in combination, producing binary additive speeds of:

X0.1 range: 0.1-1.6 inch/sec in 0.1 inch/sec steps (2.5-40 mm/sec in 2.5 mm/sec steps)

X1 range: 1-16 inch/sec in 1 inch/sec steps (25-400 mm/sec in 25 mm/sec steps)

X10 range: 10-120 inch/sec in 10 inch/sec steps (250-3000 mm/sec in 250 mm/sec steps)

Remote Drive Control ..... Rear panel BNC connector and Local/Remote switch. Switch locks out actuation by other than selected mode. TTL compatible or actuation by single-pole, single-throw switch closure. Must sink 1.6 mA.

Remote Speed Control ..... By releasing front panel speed multipliers and providing an externally supplied voltage of +0.008 to +10.0V, speed may be varied from 0.1 through 120 inch/sec (2.5-3000 mm/sec). Input impedance is 2 kΩ +1%. Polarity positive with respect to ground.

Acceleration Time ..... To 80 inch/sec (2000 mm/sec) <250 msec; to 120 inch/sec. (3000 mm/sec) <500 msec.

Speed Markings ..... Front panel marked in inch/sec and mm/sec.

Recording Periods (continous) ..... 200 ft (61 m) roll: 6.6 hr at 0.1 inch/sec (2.5 mm/sec); 20 sec at 120 inch/sec (3000 mm/sec). 100 ft (30 m) roll: 3.3 hr at 0.1 inch/sec (2.5 mm/sec); 10 sec at 120 inch/sec (3000 mm/sec).

Accuracy ..... ±5% with 1, 2, 4, 8 or 16 inch/sec (25, 50, 100, 200, 400 mm/sec) speed selector pushbuttons engaged; ±7% with additive speed selected, over full voltage and environmental range. Typically ±3% at nominal voltage and environment.

Auto Record Length Control ..... Front panel control selects from 1 to 60 sec drive time. Automatic control can be manually overridden by releasing drive switch. The cycle will be restarted when drive switch is reactuated.

Record Takeup (option) ..... Internal. Will takeup and spool full capacity of supply roll at all drive speeds, either on continuous or interrupted basis, over full environmental range. Records can be made with or without takeup as desired.

Timing System (option)

Timeline Intervals ..... Timelines recorded across min of 7.2 inch (18.3 cm) of record width each 0.001, 0.01, 0.1, 1 and 10 sec with each tenth line accentuated.

Selection ..... Front panel rotary switch permits manual or automatic selection, external synchronization, and off.

Accuracy ..... Within ±0.1% ±10 μsec over full environmental range.

Timeline Width ..... Minor: 0.010 inch (0.25 mm) max; accentuated: 0.025 inch (0.6 mm) max.

Time Interval Marker ..... Coded marking perpendicular to each accentuated tenth timeline gives indication of timing interval selected, either manually or automatically. Disabled when timeline selecter switch is in the "external" position.

Coding is:

no mark = 0.001 sec
1 mark = 0.01 sec
2 marks = 0.1 sec
3 marks = 1 sec
4 marks = 10 sec

Automatic Time Interval ..... With the timeline interval switch in the automatic position, the timeline interval is automatically established with front panel record travel speed selection:

0.1-0.7 inch/sec (2.5-17.8 mm/sec) = 1 sec timing
0.8-7 inch/sec (20.3-178 mm/sec) = 0.1 sec timing
8-70 inch/sec (203-1780 mm/sec) = 0.01 sec timing
80-120 inch/sec (2030-3048 mm/sec) = 0.001 sec timing

External Timeline Synchronization:

Max Repetition Rate 1000/sec

Input Requirements ..... DTL/TTL/CTL/RTL compatible or contact closure through rear panel BNC connector. Source must be able to sink 3 mA. Timeline is triggered on negative-going transition from +2.4 to −0.4V. Signal must remain lower than +0.4V for >100 nsec.

Max Safe Input Voltage ..... DC + ac peak, ±60V; 20V rms

Accuracy ..... Timeline will lag external signal by no more than 20 μsec.

Trace Identification (option)

Trace Marking ..... Each channel installed is identified in sequence by two dash lines placed adjacent to the trace, perpendicular to record travel. Lines are approximately 0.075 inch (2 mm) in length, spaced 0.100 inch (2.5 mm) apart and within 0.065 inch (1.6 mm) of the trace.

Trace Numbering ..... The channel number of each marked trace is placed on the righthand edge of the record in time registration with the trace marker. Characters are 7 bar system presentation having dimensions of approximately 0.125 inch (3.1 mm) high and 0.075 inch (2 mm) wide. Gridlines and timelines are inhibited within 0.065 inch (1.6 mm) of trace number.

Identifier Sequence Spacing ..... Each 0.5 ±0.1 inch (12.5 ±2.5 mm) for each succeeding trace. Vacant signal-conditioning channels are not identified. When double-width modules are installed, only the lower of the two channel numbers is identified.

Environmental

Temperature:

Operating ..... 0 to +50°C (32 to 122°F)

Nonoperating ..... −55 to +60°C (−67 to 140°F)

Rate of Change ..... 10°C (18°F) per minute max.

Humidity:

Operating ..... 5-95% relative, noncondensing (except as otherwise stated in signal conditioning module specifications).

Nonoperating ..... 5-95% relative, noncondensing

Altitude:

Operating ..... to 10,000 ft (3048 m)

Nonoperating ..... to 50,000 ft (15,240 m)

Vibration:

Operating ..... Designed and tested to requirements of MIL-T-21200G, para. 3.2.19.4 (except 5-15 Hz, 0.06 inch (1.5 mm) pk-pk; 15-25 Hz, 0.04 inch (1 mm) pk-pk; 25-55 Hz, 0.0032 inch (0.08 mm) pk-pk.

Nonoperating ..... Designed and tested to meet requirements for transportation and packaged shipping.

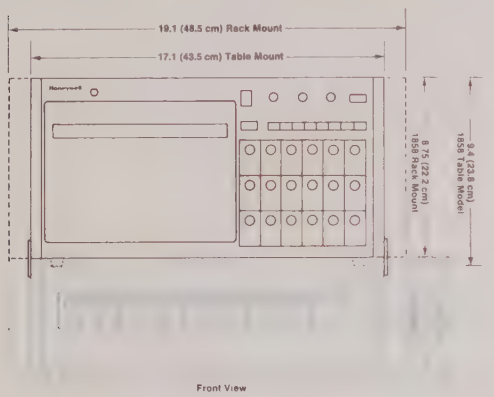
Shock ..... Designed and tested to meet requirements for normal bench handling, transportation and packaged shipping.

Packaging

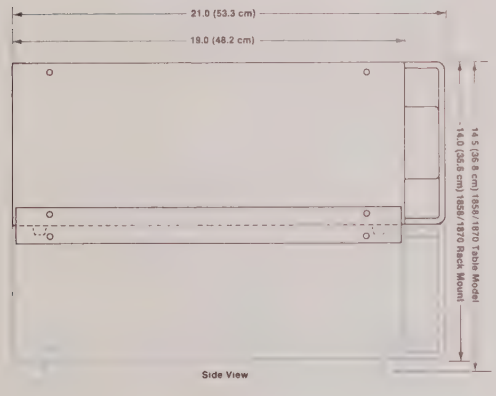
Size (Model 1858):

Table Model ..... 9.4 inch (23.8 cm) high x 17.1 inch (43.5 cm) wide x 21 inch (53.3 cm) deep.

Rack Mount ..... 8.75 inch (22.2 cm) high x 19.1 inch (48.5 cm) wide x 21 inch (53.3 cm) deep.



Front View



Side View

Size (Model 1858 with 1870 Housing).

Table Model ..... 14.5 inch (36.8 cm) high x 17.1 inch (43.5 cm) wide x 21 inch (53.3 cm) deep.

Rack Mount ..... 14 inch (35.5 cm) high x 19.1 inch (48.5 cm) wide x 21 inch (53.3 cm) deep.

Weight:

Model 1858 ..... Less signal conditioning modules or accessories, 65 lb (29.5 kg).

Model 1858/1870 ..... Less signal conditioning modules or accessories, 95 lb (43 kg).

Signal Conditioning Modules:

Single Width ..... 5 oz (141.7 gm) [1883 (A)-MPD, 1884-IFM].

Dual Width ..... 10 oz (283.5 gm) [1881-HGD, 1882-LGD, 1885(A)-SGC, 1886(A)-TCU, 1887-TCD, 1889-FVC].

Power Requirements

Table of Typical Power Requirements* (120V, 60 Hz Reference)

Paper Drive (inch/sec)	Spill-out Mode (rms watts, no signal conditioning modules installed)	Take-up Mode (rms watts, no signal conditioning modules installed)
Off	91	91
0.1	104	110
1	110	120
10	123	135
50	164	197
80	188	230
120	248	306

Signal Conditioning Modules*

Type	Watts (rms)	Type	Watts (rms)	Type	Watts (rms)
1881	2.8	1883A	1.3	1886A	2.0
1882	2.9	1884	1.2	1887	2.8
		1885A	2.8	1889	2.0

*Notes

1. Peak currents typically 2-3 times the rms value, due to peak rectifiers used in system.
2. Peak "power-on" surge current, first cycle, is approximately 14A; steady state reached in approximately 180 msec.
3. At line frequencies of 50 and 400 Hz, wattage approximately 5% greater than above figures.

Reliability

The Honeywell Model 1858 has been designed to provide the maximum in reliability and minimum maintenance. The design program included Quality Assurance design review and a mean-time-between-failure (MTBF) prediction.

To aid the user in determining maintenance requirements, the estimated MTBF of any 1858 system configuration can be determined from the table below.

This prediction was performed using MIL-HDBK-217A failure rates (paragraph 7.0) and the K-Factors for GROUND environment. A detailed parts application review (a review to ensure that all parts are correctly applied and that parts are not overstressed by voltage, current, power or temperature) was performed.

Based on the fact that all the parts are correctly applied and are not overstressed, the prediction was performed in accordance with MIL-HDBK-217A, para. 4.5, utilizing specific parts count on part types operating at an ambient temperature of 50°C. The stress ratios selected were those that are typical of Honeywell's derating practice.

The estimated mean time between failure assumes an exponential distribution. The failure rate allocations for the specific system elements are summarized in the table.

MTBF TABLE

Component	Number of Units(n)	Failures per 10^6 Hrs(λ)	nλ
Basic 1858 (less options & signal conditioning modules)		361.82	
1870 Housing		90.91	
Trace Identification Option		16.60	
Timeline Option		14.90	
1881-HGD Signal Conditioning Module		63.19	
1882-LGD Signal Conditioning Module		58.76	
1883-MPD Signal Conditioning Module		29.88	
1884-IFM Signal Conditioning Module		20.74	
1885-SGC Signal Conditioning Module		62.18	
1886-TCU Signal Conditioning Module		43.00	
1887-TCD Signal Conditioning Module		58.14	
1889-FVC Signal Conditioning Module		66.22	

Total = _____

MTBF (in hrs) = $\frac{1}{\text{Total} \times 10^{-6}}$

Example:

1858 with timeline option and three 1884 modules:

1 x 361.82 = 361.82
1 x 14.90 = 14.90
3 x 20.74 = 62.22
Total = 438.94

MTBF = $1/438.94 \times 10^{-6}$

MTBF = 2.278 hr

Signal Conditioning Modules

A selection of plug-in signal-conditioning modules gives the 1858 Graphic Data Acquisition System exceptional adaptability to unique or changing test and measurement problems. While each signal-conditioning module is designed to accommodate a wide range of input signals, certain measurements may require signal conditioning having different characteristics, or it may be desired to increase channel capacity. In either case, it is only necessary to insert the appropriate signal-conditioning module into the 1858 system and to connect the signal-input leads.

Each signal-conditioning module is complete with all controls required for its particular function, an analog-input section and a voltage-to-time (PDM) converter; thus, no adjustments or changes to other portions of the 1858 system are required when adding or changing channels. Blank panels are available for unused channel positions.

Frequency response of the 1858 system and its signal conditioning modules is primarily dependent upon "sample-rate error". Sample-rate error is that introduced as a result of the sweep excursion time in relation to the rate of change of the analog signal input and, therefore, increases as the signal-input frequency is increased.

Due to the sampling system utilized in the 1858, transients of less than 20 μsec duration may or may not be recorded, depending upon the occurrence of the transient in relation to the start of the horizontal sweep.

Signal inputs to the signal-conditioning modules are made through 5-pin, MS-type connectors on the rear panel of the 1858. The system is fully wired and chassis connectors are provided for 18 channel capacity. One mating connector (Amphenol P/N 165-33, Honeywell P/N 16773755-001) is furnished with each signal conditioning module purchased.

The Models 1883(A)*-MPD and 1884 IFM signal conditioning modules are provided with auxiliary BNC connectors on the front panel to permit access for tests without disturbing the rear input.

Complete specifications for each signal-conditioning module are on the following pages.

**The 188X and 188X(A) modules are identical when used in the 1858. The 188X(A) has the amplified (or attenuated) analog signal routed to the rear of the module for use in the Model 1871 amplifier system. This output is not accessible in the Model 1858.*

Model 1881–HGD High Gain Differential Amplifier Module

Description

The 1881-HGD is a high gain, floating and guarded dc amplifier, designed to accept low level input signals. System sensitivity is ±1 mV to ±1V/div (1 inch, 25 mm), with common mode voltage capability to ±300V peak. It occupies two paired module spaces (for example, channels 1 and 2) of the 1858 system.

If the module input is connected to a source that can deliver more than 1A, U.L. requirements state that a fuse with less than 1A rating and with sufficient current interruption capability be placed in series with the signal input leads.

Front Panel Controls

Sensitivity ..... 9 position rotary switch, with knob, to set the system sensitivity in calibrated steps.

Variable Sensitivity ..... Multiturn screwdriver-adjustable control to vary the amplifier sensitivity between calibrated steps and extends range to 1V/div.

Position ..... Multiturn screwdriver-adjustable control positions trace at any point across the record width.

Trace ..... 4 position rotary switch with knob: OFF position removes signal and eliminates trace by placing it off-scale. NORMal position produces right-to-left trace deflection (facing the 1858) with positive signal on the non-inverting input terminal. REVerse position reverses trace deflection. ZERO position shorts output, ahead of the position control, to remove signal influence for trace positioning.

Trim ..... Multiturn screwdriver-adjustable control permits precise setting of system sensitivity.

Balance ..... Multiturn screwdriver-adjustable control allows the amplifier dc output to be zeroed (with no input signal).

Specifications

Input:

Type ..... Floating and guarded; preferred connection is guard lead connected to signal low lead at signal source.

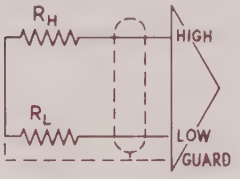
Impedance ..... >10 MΩ shunted by <120 pF

Offset Current ..... 50 nA max

Max Safe Input Voltage ..... ±50V dc or peak ac

Max Safe Common Mode Voltage ..... ±300V dc or peak ac

Source Resistance ..... All specifications apply for $R_H \leq 350\Omega$ and with resistance of R_L no greater than the following:



R_L ohms	Sensitivity mV/div
10	1
20	2
50	5
100	10
200	20
350	50-1000

Sensitivity:

Steps ..... 1, 2, 5, 10, 20, 50, 100, 200, 500 mV/div

Accuracy ..... Adjustable to within ±0.5% full scale, relative to gridlines (trim control). Ratio accuracy between steps within ±2.0%, typical ±0.5% at ≤25°C (77°F) and ≤50% R.H.

Linearity ..... Within ±0.5% full scale, relative to gridlines.

Stability ..... Within ±0.05% full scale, per degree C, relative to gridlines.

Frequency Response:

dc to 2 kHz ..... +0%, −3% max error

dc to 3 kHz ..... +0%, −5% max error

dc to 5 kHz ..... +0%, −12% max error

Drift ..... Distance on record per degree C relative to gridlines.

$$\text{inch} = 0.002 + \left(\frac{0.007}{\text{Sens. in mV/div}}\right)$$

$$\text{mm} = 0.05 + \left(\frac{0.175}{\text{Sens. in mV/div}}\right)$$

Noise (wideband):

1 mV/div sensitivity ..... <0.06 inch (1.5 mm) pk-pk, plus static trace width, on record.

2 mV/div sensitivity ..... <0.04 inch (1 mm) pk-pk, plus static trace width, on record.

5 mV/div sensitivity ..... <0.035 inch (0.9 mm) pk-pk, plus static trace width, on record.

10-1000 mV/div sensitivity ..... <0.030 inch (0.75 mm) pk-pk, plus static trace width, on record.

Common Mode Rejection, Typical (dc-60 Hz):

Sensitivity	≤ 25°C, ≤50% RH	≤ 50°C, ≤ 80% RH
1 mV/div	> 100 dB	> 80 dB
2 mV/div	> 94 dB	> 74 dB
5 mV/div	> 86 dB	> 66 dB
10-1000 mV/div	> 80 dB	> 66 dB

Crosstalk ..... Negligible

Overload Recovery ..... <1 msec to within 0.030 inch (0.75 mm) of final value for 10 times input overload. to a max of ±50V peak.

Filtering ..... Internal terminals for user installed components for one 12 dB/octave low pass filter.

Output ..... TTL logic level pulses with pulse duration proportional to input signal level for interfacing with 1858 system. No external outputs are provided.

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system except as stated above.

Model 1882—LGD Low Gain Differential Amplifier Module

Description

The 1882-LGD is a low gain, floating and guarded dc amplifier. It is designed to accept high level input signals, giving a system sensitivity of ±100 mV to ±200V/div (1 inch, 25 mm) to a maximum of ±300V, at common mode voltages to ±300V peak. It occupies two paired module spaces (for example, channels 1 and 2) of the 1858 system.

If the module input is connected to a source that can deliver more than 1A, U.L. requirements state that a fuse with less than 1A rating and with sufficient current interruption capability be placed in series with the signal input leads.

Front Panel Controls

Sensitivity ..... 10 position rotary switch, with knob, to set the system sensitivity in calibrated steps.

Variable Sensitivity ..... Multiturn screwdriver-adjustable control to vary the amplifier sensitivity between calibrated steps and extends range to 200V/div.

Position ..... Multiturn screwdriver-adjustable control positions trace at any point across the record width.

Trace ..... 4 position rotary switch with knob: OFF position removes signal and eliminates trace by placing it off-scale. NORMal position produces right-to-left trace deflection (facing the 1858) with positive signal on the non-inverting input terminal. REVerse position reverses trace deflection. ZERO position shorts output, ahead of the position control, to remove signal influence for trace positioning.

Trim ..... Multiturn screwdriver-adjustable control permits precise setting of system sensitivity.

Balance ..... Multiturn screwdriver-adjustable control allows the amplifier dc output to be zeroed (with no input signal).

Specifications

Input:

Type ..... Floating and guarded, preferred connection is guard lead connected to signal low lead at signal source.

Impedance ..... >1 MΩ shunted by <120 pF

Offset Current ..... Negligible

Max Safe Input Voltage ..... ±300V dc or peak ac

Max Safe Common Mode Voltage ..... ±300V dc or peak ac

Source Resistance ..... All specifications for 0-1 kΩ, and with no more than 350Ω in low input lead.

Sensitivity:

Steps ..... 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100V/div.

Accuracy ..... Adjustable to within ±0.5% full scale, relative to gridlines (trim control). Ratio accuracy between steps within ±2.0%, typical ±0.5% at ≥25°C (77°F) and ≥50% R.H.

Linearity ..... Within ±0.5% full scale, relative to gridlines.

Stability ..... Within ±0.05% full scale, per degree C, relative to gridlines.

Frequency Response:

dc to 2 kHz ..... +0%, −3% max error

dc to 3 kHz ..... +0%, −5% max error

dc to 5 kHz ..... +0%, −12% max error

Drift ..... <±0.003 inch (0.075 mm) on record per degree C, relative to gridlines, at any sensitivity setting.

Noise (wideband) ..... <0.010 inch (0.25 mm) pk-pk, plus static trace width, on record, at any sensitivity setting.

Common Mode Rejection, Typical (dc-60 Hz):

Sensitivity	≤ 25°C, ≤ 50% RH	≤50°C, ≤ 80% RH
0.1V/div	> 86 dB	> 80 dB
0.2V/div	> 80 dB	> 74 dB
0.5V/div	> 72 dB	> 66 dB
1V/div	> 66 dB	> 60 dB
2V/div	> 60 dB	> 54 dB
5V/div	> 52 dB	> 46 dB
10V/div	> 46 dB	> 40 dB
20V/div	> 40 dB	> 34 dB
50V/div	> 32 dB	> 26 dB
100V/div	> 26 dB	> 20 dB

Crosstalk ..... Negligible

Overload Recovery ..... <1 msec to within 0.030 inch (0.75 mm) of final value for 10 times full scale input overload, to a max of ±300V peak.

Filtering ..... Internal terminals for user installed components for one 12 dB/octave low pass filter.

Output ..... TTL logic level pulses with pulse duration proportional to input signal level for interfacing with 1858 system. No external outputs are provided.

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system except as noted above.

Model 1883(A)–MPD Medium Gain Differential Amplifier Module

Description

The 1883(A)-MPD is a medium-gain, differential dc amplifier. It is designed to accept moderately low level input signals, giving a system sensitivity of ±50 mV to ±1V/div (1 inch, 25 mm) at common mode voltages to ±15V peak. Internal jumper pins allow for disabling the rear input in favor of a front panel BNC input connector. It occupies a single module space in the 1858 system.

Front Panel Controls

Sensitivity ..... 5-position rotary switch, with knob, to set the system sensitivity in calibrated steps. In OFF position, removes signal and eliminates trace by placing it off scale.

Variable Sensitivity ..... Multiturn screwdriver-adjustable control to vary the amplifier sensitivity between calibrated steps. At min setting, extends min sensitivity to 1V/div.

Position ..... Multiturn screwdriver-adjustable control positions trace at any point across the record width.

Trim ..... Multiturn screwdriver-adjustable control permits precise setting of system sensitivity.

Internal Controls

Balance ..... Single turn screwdriver-adjustable control allows the amplifier dc output to be zeroed (with no input signal).

Normal/Reverse ..... Internal jumper pins allow reversal of trace deflection. NORMal position produces right-to-left trace deflection (facing the 1858) with positive signal on the noninverting input terminal. REVerse position reverses trace deflection.

Input Selection ..... Internal jumper pins allow rear (MS) input to be disabled and input transferred to front panel BNC connector. BNC may be used in single-ended, grounded configuration only.

Specifications

Input:

- Type ..... Differential
- Impedance:
  - Differential ..... 1 ±0.01 MΩ shunted by <100 pF
  - Single-ended ..... Normal polarity: 1 ±0.01 MΩ shunted by <100 pF. Reverse polarity: 500 kΩ shunted by <100 pF.
- Max Safe Input Voltage ..... ±20V dc or peak ac
- Max Safe Common Mode Voltage ..... ±15V dc or peak ac
- Max Operating Common Mode Voltage .... ±10V dc or peak ac
- Source Resistance ..... All specifications apply for 0-10 kΩ, with 0-1 kΩ unbalance, except as separately specified.
- Offset Current ..... 10 nA max

Sensitivity:

- Steps ..... 50, 100, 200, 500 mV/div.
- Accuracy ..... Adjustable to better than ± 0.5% full scale, relative to gridlines (trim control). Ratio accuracy between steps within ±1%.
- Linearity ..... Within ±0.4% full scale, relative to gridlines.
- Stability ..... Within ±0.02% full scale, per degree C, relative to gridlines.

Frequency Response:

- dc to 1 kHz ..... +0%, −0.5% max error
- dc to 2 kHz ..... +0%, −1.3% max error
- dc to 3 kHz ..... +0%, −3% max error
- dc to 5 kHz ..... +0%, −8% max error

Drift ..... <0.005 inch (0.125 mm) on record, relative to gridlines per degree C at any sensitivity setting.

Noise (wideband) ..... <0.016 inch (0.4 mm) pk-pk, plus static trace width, on record at any sensitivity setting.

Common Mode Rejection (dc-60 Hz) ..... No source unbalance, >54 dB; 1 kΩ source unbalance, >50 dB.

Crosstalk ..... <0.010 inch (0.25 mm) pk-pk, plus static trace width, on record at any sensitivity setting.

Overload Recovery ..... <1 msec to within 0.030 inch (0.75 mm) of final value for 10 times input overload, to a max of 20V peak.

Filtering ..... Internal terminals for user installed components for one 12 dB/octave low pass filter.

Output ..... TTL logic level pulses with pulse duration proportional to input signal level for interfacing with 1858 system. No external outputs are provided.

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system.

Model 1884—IFM Interface Module

Description

The 1884-IFM adapts the 1858 system to signal sources (such as unique or existing signal conditioning units, voltage sources, etc.), where the source impedance is sufficiently low and the signal levels are sufficiently high that additional amplification and impedance matching are not required. The 1884-IFM consists only of the voltage-to-time converter portion of other signal conditioning modules. Sensitivity is ±1V/div (1 inch, 25 mm). The rear MS and front panel BNC connectors are connected in parallel in a single-ended, grounded configuration. It occupies a single module space in the 1858 system.

Front Panel Controls

Position ..... Multiturn screwdriver-adjustable control positions trace at any point across the record width.

Trace ..... 2 pole toggle switch. OFF position eliminates trace by placing it off scale.

Trim ..... Multiturn screwdriver-adjustable control permits precise setting of system sensitivity, range ±10%.

Specifications

Input:

- Type ..... Single ended, grounded
- Impedance ..... 3.74 ±0.5 kΩ shunted by <100 pF
- Max Safe Input Voltage ..... ±25V dc or peak ac
- Source Resistance ..... 1 kΩ max; 10Ω max when connected in parallel with other recording devices.

Sensitivity:

- Steps 1V/div
- Accuracy ..... Adjustable to within ±0.5% full scale, relative to gridlines (trim control).
- Linearity ..... Within ±0.4% full scale, relative to gridlines.
- Stability ..... Within ±0.02% full scale, per degree C, relative to gridlines.

Frequency Response:

- dc to 1 kHz ..... +0%, −0.2% max error
- dc to 2 kHz ..... +0%, −0.8% max error
- dc to 3 kHz ..... +0%, −1.8% max error
- dc to 5 kHz ..... +0%, −5% max error

Drift ..... ±0.002 inch (0.05 mm) on record relative to gridlines per degree C at any sensitivity setting.

Noise ..... <0.016 inch (0.4 mm) pk-pk, plus static trace width, on record.

Crosstalk ..... Negligible

Overload Recovery ..... <1 msec to within 0.030 inch (0.75 mm) of final value for 10 times input overload, to a max of ±25V peak.

Output ..... TTL logic level pulses with pulse duration proportional to input signal level for interfacing with 1858 system. No external outputs are provided.

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system.

1885(A)–SGC Strain Gage Control Module

Description

The 1885(A)-SGC provides a convenient means for making accurate strain gage measurements with the 1858 system. In addition to signal amplification, the 1885(A)-SGC provides gage excitation and balance as well as calibration and suppression of the input signals. Sensitivity is from 1 to 100 mV/div (1 inch, 25 mm). By changing internal jumper pins, the 1885(A)-SGC may also be used as a high-gain differential dc amplifier, with both calibration and suppression, for low-level inputs. Its ability to be used with strain gage, thermocouple or other low-level signals makes it an ideal choice where flexibility is required. It occupies two paired module spaces (for example, channels 1 and 2) in the 1858 system.

Operating Controls

Gage Excitation ..... Internal jumper pins for selection of gage excitation voltages of 2.5, 5, or 10V.

Balance ..... Front panel, multiturn screwdriver-adjustable control to cancel residual gage unbalance. May be disabled via internal jumper pins for other than strain gage applications.

Calibration/Suppression ..... Front panel, multiturn control with high-torque counting dial, calibrated from 0-10.00 mV. Applies a precise calibration voltage to the amplifier input for adjustment of system sensitivity when the TRACE switch is in the ZERO position. Front panel, toggle switch extends range to 100.0 mV. Separate front panel three-position toggle switch selects + or − polarity or off. With the TRACE switch in either the NORMal or REVerse position, the calibration voltage may be used for signal input suppression of either polarity and either range by dialing the desired value with the CAL/SUP control.

Sensitivity ..... Front panel, multiturn screwdriver-adjustable control, in combination with internal jumper pins, allows sensitivity control range to be set from 1 through 100 mV/div. Settings are: 1-4.5 mV/div; 4-14 mV/div; 13-39 mV/div; 36-100 mV/div.

Position ..... Front panel, multiturn screwdriver-adjustable control positions trace at any point across the record width.

Trace ..... Front panel, 4-position rotary switch with knob. OFF position removes signal and eliminates trace by placing it off scale. ZERO position shorts input for establishing calibration without external signal influence. NORMal position produces right-to-left trace deflection (facing the 1858) with positive signal on the positive (non-inverting) input terminal. REVerse position reverses trace deflection.

Specifications

Gage Excitation and Balance:

Voltage ..... 2.5, 5.0, or 10.0V dc ±0.25%

Current ..... 45 mA limited to not more than 75 mA. A continuous short will not cause permanent damage or affect other channels.

Ripple ..... <2 mV pk-pk, dc-25 kHz, measured during 15 μsec horizontal scan period of 1858 system.

Load Regulation ..... < ±0.1% of selected voltage, no load to full load.

Line Regulation ..... < ±0.1% of selected voltage for ±10% line input variation to 1858 system.

Temperature Coefficient ..... < ±0.025% of selected voltage, per degree C.

Sensing ..... Local or remote, selectable by internal jumper pins. Remote sensing leads appear at input connector of odd numbered channel.

Sense Lead Error ..... < ±0.5% of set voltage/16Ω sense lead resistance.

Balance Method ..... Shunt balance

Balance Range ..... Will balance >0.5Ω unbalance of a 120Ω gage; >4.0Ω unbalance of a 350Ω gage.

Bridge Completion ..... Completion resistors for other than 4-arm bridges must be made external to the 1858 system and can be arranged for 3-wire, one-arm configuration.

Calibration and Suppression:

Range ..... 1-10.00 mV and 10-100.0 mV. Range and polarity selected by front panel toggle switches. Front panel dial indicates set voltage.

Accuracy ..... Within ±0.1% at full scale setting at 25°C (77°F).

Linearity ..... Within ±0.5% of full scale

Drift ..... <±0.025% of setting per degree C.

Amplifier Input:

Type ..... Differential. By proper input, connections can be used with millivolt signal sources other than strain gages.

Impedance ..... >1 MΩ shunted by <100 pF

Source Resistance ..... All specifications apply for 0-1 kΩ, with 0-1 kΩ unbalance, except as separately stated.

Offset Current ..... 100 nA

Max Safe Input Voltage ..... ±10V dc or peak ac

Max Operating Input Voltage ..... ±0.4V

Max Safe Common Mode Voltage ..... ±10V dc or peak ac

Common Mode Voltage, Operating ..... 0 to +5V dc or ac peak with suppression; −2 to +5V dc or ac peak without suppression.

Linearity ..... Within ±0.5% of full scale relative to gridlines.

Stability ..... Within ±0.025%, per degree C, relative to gridlines.

Sensitivity:

Range ..... 1 to 100 mV/div, continuously adjustable.

Accuracy ..... Adjustable to better than ±0.5% full scale relative to gridlines (SENS control).

Frequency Response:

dc to 1 kHz ..... +0%, −3% max error

dc to 2 kHz ..... +0%, −8% max error

dc to 3 kHz ..... +0%, −18% max error

dc to 5 kHz ..... +0%, −35% max error

Drift ..... <0.007 inch (0.175 mm) trace displacement per degree C, relative to gridlines at max gain. Typically <0.005 inch/°C (0.125 mm/°C).

Noise ..... <0.02 inch (0.5 mm) pk-pk, plus static trace width, at max sensitivity setting.

Common Mode Rejection (dc-60 Hz) ..... >60 dB at any amplifier gain setting, with 350Ω source unbalance.

Crosstalk ..... Negligible

Overload Recovery ..... <10 msec to within 0.030 inch (0.75 mm) of final value for 10 times input overload to a max of ±10V peak.

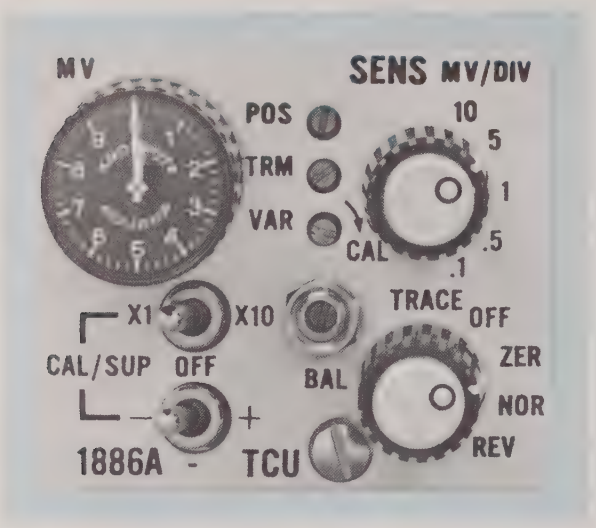
Filtering ..... Internal terminals for user-installed components for one 6 dB/octave low pass filter.

Output ..... TTL logic level pulses with pulse duration proportional to input-signal level for interfacing with 1858 system. No external outputs are provided.

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system.

1886(A) – TCU Thermocouple Control and Microvolt Amplifier Module



Description

The 1886(A)-TCU provides a convenient means of making accurate thermocouple-type temperature measurements, or other measurements where the signal levels are in the microvolt region. In addition to its sensitivity range of from 100 μV to 50 mV/div (1 inch, 25 mm), the 1886(A)-TCU provides dial-in input calibration and suppression of 1 to 100 mV. By using this calibration and suppression capability, the nonlinearities of thermocouples can frequently be disregarded. Accessory thermocouple compensation units are available for the most commonly used thermocouple types. The 1886(A)-TCU occupies two paired module spaces (for example, channels 1 and 2) in the 1858 system.

Front Panel Controls

Sensitivity ..... Front panel 5-position rotary switch, with knob, to set the system sensitivity in calibrated steps.

Variable Sensitivity ..... Multiturn screwdriver-adjustable control to vary the amplifier sensitivity between calibrated steps. At min setting, extends min sensitivity to 50 mV/div.

Position ..... Multiturn screwdriver-adjustable control positions trace at any point across the record width.

Trim ..... Multiturn screwdriver-adjustable control permits precise setting of system sensitivity.

Trace ..... 4-position rotary switch, with knob. OFF position removes signal and eliminates trace by placing it off scale. ZERO position removes the signal input and shorts the amplifier input for positioning trace and calibrating without signal influence. NORMal position produces right-to-left trace deflection (facing the 1858) with positive signal on positive (non-inverting) input terminal. REVerse position reverses trace deflection.

Calibration/Suppression ..... 10-turn control with high-torque, counting dial calibrated from 0 to 10.00 mV applies a precise calibration voltage to the amplifier input for adjustment of system sensitivity when the TRACE switch is in the ZERO position. Toggle switch extends range to 100.0 mV. Separate 3-position toggle switch selects + or – polarity or off. With the TRACE switch in either NORMal or REVerse position, the calibration voltage may be used for input suppression of either polarity and either input range by dialing the desired value with the CAL/SUP control.

Balance ..... Multiturn screwdriver-adjustable control allows the amplifier output to be zeroed (with no input signal).

Specifications

Input:

Type ..... Differential

Impedance ..... >1 MΩ shunted by <100 pF

Source Resistance ..... Sensitivity of 0.1 mV/div, 1000Ω max; sensitivity of 0.5 mV/div, 500Ω max; sensitivity of 1-50 mV/div, 1 kΩ max.

Offset Current ..... <20 nA

Max Safe Input Voltage ..... ±20V dc or peak ac

Max Safe Common Mode Voltage ..... ±20V dc or peak ac

Max Operating Common Mode Voltage .... ±5V dc or peak ac

Sensitivity:

Steps ..... 0.1, 0.5, 1, 5, 10 mV/div

Accuracy ..... Adjustable to within ±0.5% full scale, relative to gridlines (trim control). Ratio accuracy between steps within ±0.5% full scale.

Linearity ..... Within ±0.5% full scale, relative to gridlines.

Stability ..... Within ±0.5% full scale per degree C, relative to gridlines.

Frequency Response:

Sensitivity	−5%	−10%	−3 dB
0.1 mV/div	5 Hz	7.5 Hz	15 Hz
0.5 mV/div	160 Hz	250 Hz	500 Hz
1-50 mV/div	1600 Hz	2500 Hz	5000 Hz

Drift:
(inches on record per degree C)

Sensitivity	Max	Typical
0.1 mV/div	0.042	0.018
0.5 mV/div	0.010	0.006
1 mV/div	0.006	0.005
5-50 mV/div	0.003	0.003

Noise (wideband) ..... 0.1 to 0.5 mV/div: <0.025 inch (0.625 mm) pk-pk on record, plus static trace width; 1 to 50 mV/div: <0.015 inch (0.375 mm) pk-pk, plus static trace width.

Common Mode Rejection (dc-60 Hz) ..... 0.1 mV/div: >100 dB (typically >105 dB); 0.5 to 50 mV/div: >90 dB (typically >100 dB).

Crosstalk ..... DC to 100 Hz: <0.010 inch (0.25 mm) pk-pk on record, plus static trace width, at max sensitivity; dc to 5 kHz, <0.030 inch (0.75 mm) pk-pk, plus static trace width, at max sensitivity.

Overload Recovery ..... Sensitivity of 0.1 and 0.5 mV/div: <200 msec to within 0.030 inch (0.75 mm) of final value for 10 times overload to a max of ±20V peak; sensitivity of 1 to 50 mV/div: <1 msec.

Filtering ..... Internal terminals for user-installed components for one 6 dB/octave low-pass filter.

Output ..... TTL logic level pulses with pulse duration proportional to input signal level for interfacing with 1858 system. No external outputs are provided.

Calibration and Suppression:

Range ..... 1.0 to 10.00 and 10.0 to 100.0 mV. Range and polarity selected by front panel toggle switches. Front panel dial indicates set voltage.

Accuracy ..... Within ±0.1% at full scale setting at 25°C (77°F).

Linearity ..... Within ±0.5% of full scale.

Drift ..... <±0.25% of setting per degree C.

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system.

Model 1887 – TCD Tape Compatible Differential Amplifier Module

Description

The 1887-TCD is a high-sensitivity, wide gain-range, differential amplifier which conveniently and simultaneously provides input signal conditioning for the Model 1858 Visicorder oscillograph and instrumentation-type magnetic tape recorders. A front panel switch allows selection of either parallel recording on the 1858 and the tape recorder, or serial playback recording from the tape recorder to the Model 1858. Changing from serial to parallel, or vice versa, does not necessitate changing connections or sensitivity settings. In the serial recording mode, recordings beyond the 5 kHz frequency range capability of the Model 1858 can be recorded on the tape at high speed and then played back at a lower speed into the Model 1858, yielding time scale expansion. Similarly, long term, slow speed tape recordings can be played back at high speed in a few seconds, yielding time scale compression and displaying long periods on a relatively short record.

The serial arrangement may also be used "on-line" wherein the Model 1858, in addition to serving as a "quick-look" monitor and providing a permanent record, verifies that the data is recorded on the tape. Front panel switch selection allows ±1, 2 or 4 division trace amplitude for full scale (±1.414V) tape record or playback. System sensitivity is from ±10 mV to ±25V/div (1 inch, 25 mm) and for ±1.414V (1V rms) output to the tape recorder. A full-scale RTI calibration voltage allows setting of trace amplitude and/or FM tape recorder deviation. The 1887-TCD occupies two paired module spaces of the 1858 system (for example, channels 1 and 2). Interconnection with the tape recorder is made via the odd-numbered MS type connector on the rear of the Model 1858. Terminal C is output to the tape recorder, terminal A is input from the tape recorder, terminal E is common.

If the module input is connected to a source that can deliver more than 1A, U.L. requirements state that a fuse with less than 1A rating and with sufficient current interruption capability be placed in series with the signal input leads.

Front Panel Controls

Sensitivity ..... 12-position rotary switch, with knob, to set system sensitivity in 10 calibrated steps, plus zero and full-scale calibration. ZERo position removes signal and shorts amplifier input to allow setting of trace position. The FS position removes signal input and substitutes a fixed dc level equivalent to full scale at the amplifier input to allow adjusting trace amplitude and FM tape recorder deviation.

Variable Sensitivity ..... Multiturn screwdriver-adjustable control to vary the amplifier sensitivity between calibrated steps and extend range to ±25V/div and ±1.414V tape output.

Position ..... Multiturn screwdriver-adjustable control to position trace at any point across the record width. Does not affect output to tape recorder.

Trim ..... Multiturn screwdriver-adjustable control permits precise setting of trace sensitivity.

Trace ..... Four-position rotary switch selects ±1, 2 or 4 div trace deflection for ±1.414V tape record or playback. OFF position eliminates trace by placing it off-scale. Trace switch does not affect output to tape recorder.

Serial-Parallel ..... Two-position toggle switch. SERial position applies conditioned signal to input of tape recorder only with 1858 trace deflection signal from output of tape recorder. PARallel position simultaneously applies conditioned signal to 1858 trace and input to tape recorder and opens circuit from output of tape recorder.

Internal Controls

Tape Trim ..... Multiturn screwdriver-adjustable control permits precise adjustment of output to tape recorder.

Normal-Reverse ..... Jumper pins allow reversal of trace deflection. Normal position (+) produces right-to-left trace deflection (facing the 1858) with positive signal on the noninverting input terminal. Reverse position (−) reverses trace deflection. Does not affect output to tape recorder.

Balance ..... Two multiturn, screwdriver-adjustable controls allow the amplifier dc output to be zeroed (with no input signal).

CM Adjustment ..... Two multiturn, screwdriver-adjustable controls allow common mode rejection ratios to be optimized for 0.01 to 0.5V/div and 1 to 10V/div sensitivity ranges.

Specifications

Input Signal

Type	Differential
Impedance:	
Differential	2 ±0.1 MΩ shunted by <80 pF
Single-Ended	1 ±0.05 MΩ shunted by <160 pF
Max Safe Input Voltage:	
Sensitivity 0.01-0.5V/div	±100V dc or peak ac
Sensitivity 1.0-10V/div, FS, Zero	±300V dc or peak ac
Max Operating Input Voltage	±6X input sensitivity setting (±6 div)
Max Safe Common Mode Voltage:	
Sensitivity 0.01-0.5V/div	±100V dc or peak ac
Sensitivity 1.0-10V/div, FS, Zero	±300V dc or peak ac
Max Operating Common Mode Voltage:	
Sensitivity 0.01-0.5V/div	±5V dc or peak ac
Sensitivity 1.0-10V/div, FS, Zero	±300V dc or peak ac
Common Mode Resistance to Ground	0.5 ±0.025 MΩ
Source Resistance	All specifications apply for 0-1 kΩ, with 1 kΩ unbalance, except as separately specified.
Offset Current	50 nA max
Sensitivity:	
Steps	10 steps; ±0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0V/div and V/±1.414V output to tape.
Accuracy	Adjustable to better than ±0.5% full-scale, relative to gridlines (trim control). Total of ratio accuracy between steps and gain stability over full environmental range is within ±1%.
DC Linearity	Within ±0.5% full scale (6 div) relative to gridlines.
Frequency Response (Signal Input to 1858 Trace):	
dc to 1 kHz	+0%, −0.5% max error
dc to 2 kHz	+0%, −1.3% max error
dc to 3 kHz	+0%, −3% max error
dc to 5 kHz	+0%, −10% max error
Frequency Response (Signal Input to Tape Output):	
dc to 50 kHz	+0.5 dB, −1.0 dB
dc to 80 kHz	+1.0 dB, −1.5 dB
dc to 100 kHz	+1.5 dB, −3.0 dB
Drift	<±0.003 div/°C relative to gridlines on record at any sensitivity setting, with trace switch at X1.

(continued on next page)

Noise (wideband) ..... <0.015 div pk-pk, plus static trace width switch, on record at any sensitivity setting, with trace switch at X1.

Common Mode Rejection (dc-60 Hz):

Sensitivity V/Div.	1 kΩ Source Unbalance (Minimum)	No Source Unbalance (Minimum)	No Source Unbalance (Typical)
0.01	50 dB	60 dB	90 dB
0.02	50 dB	60 dB	88 dB
0.05	50 dB	60 dB	86 dB
0.1	50 dB	60 dB	82 dB
0.2	50 dB	60 dB	76 dB
0.5	50 dB	60 dB	70 dB
1.0-10.0	50 dB	60 dB	64 dB

Crosstalk ..... <0.035 div pk-pk, plus static trace width, on record at any sensitivity setting, with trace switch at X1.

Overload Recovery ..... <100 μsec to within ±1% of final value for 10 times sensitivity. V/div setting, to a max of 100V peak.

Filtering ..... Internal terminals for user-installed components for 12 dB/octave low pass filter. Does not affect output to tape recorder.

Input (From Tape Recorder)

Type ..... Single-ended to ground

Input Impedance ..... 20 ±2 kΩ

Source Resistance ..... Limited only by source loading considerations.

Max Safe Input Voltage..... ±10V dc or peak ac

Max Operating Input Voltage ..... ±9V dc or peak ac

Sensitivity ..... ±1.414V (1V rms) produces ±1, ±1%, division trace movement on the Model 1858 with trace switch in X1 position.

Frequency Response:

dc to 1 kHz..... +0%, −0.5% max error

dc to 1 kHz..... +0%, −1.3% max error

dc to 3 kHz..... +0%, −3% max error

dc to 5 kHz..... +0%, −8% max error

DC Offset ..... ±0.015 div max, with trace switch at X1.

Output (To Tape Recorder)

Impedance ..... <2Ω

Voltage ..... ±1.414V, ±1% for 1X sensitivity dial setting, to a max of 6X, into ≥10 kΩ.

Noise:

Wideband ..... <50 mV pk-pk

To 10 kHz ..... <15 mV pk-pk (typical)

Spikes ..... <200 mV pk-pk at approximately 3 MHz, decaying in approximately 5 cycles at 50 kHz rate.

Drift ..... <±4 mV/°C RTO (equivalent to 0.003 div/°C on 1858 trace with trace switch at X1)

General

Power ..... Draws all required power from 1858 system.

Environmental ..... Same as 1858 system.

Mean Time Between Failures (MTBF)..... >17,000 hr

Model 1889A-FVC/1889B-FVC Frequency-to-Voltage Converter Modules

Description

The Models 1889A-FVC and 1889B-FVC provide a dc output directly proportional to the frequency, but independent of the amplitude, of an ac or pulsed dc input signal. Designed primarily for use with magnetic pulse type speed or flow transducers, the 1889 modules may be used as well to measure and record frequency or frequency deviation from other signal sources in a variety of applications.

In addition to producing analog recordings on the Model 1858 Visicorder oscillograph, an auxiliary output is provided for magnetic tape recording or for other recording, display, alarm or control purposes. The modules also feature a precision crystal oscillator having selectable frequencies for convenience and accuracy in set-up and calibration. Full scale frequency input can produce up to full width recording on the Model 1858 and up to +5.0V at the auxiliary output.

The Model 1889A-FVC has seven ranges to a maximum of 6.4 kHz input frequency. The 1889B-FVC also has seven ranges but to a maximum of 51.2 kHz. Both have selection of "fast" or "slow" response time.

The modules occupy two paired module spaces of the Model 1858. Signal input is to the even-numbered connector on the rear of the Model 1858; the auxiliary output is from the odd-numbered connector.

Ordering Information

The ordering code system below has been developed for ordering convenience and accuracy. Proper and complete coding will assure filling your order correctly and promptly. As a suffix to the basic Model 1858, indicate your selections by the proper order code numbers and letters in the same order as the columns. If an option is not required, insert a letter "O" in the appropriate location.

Selection of Features to be installed	Basic System	Take-up	Timing	Trace Ident.	Housing Interface	UL Listing
Basic Model No. 120/240V, 50-400 Hz	1858					
With Internal Takeup		T				
Five Interval Timing System			7			
Numbered Trace Identification				9		
Added Channel Housing					H	
UL 1244						G
UL 544						M

Signal Conditioning

1881-HGD* ..... High-gain differential amplifier module

1882-LGD* ..... Low-gain differential amplifier module

1883(A)-MPD* ..... Medium-gain differential amplifier module

1884-IFM* ..... Interface module

1885(A)-SGC* ..... Strain gage control module

1886(A)-TCU* ..... Thermocouple control and microvolt amplifier module

1887-TCD* ..... Tape compatible differential amplifier module

1889A/B-FVC* ..... Frequency-to-voltage convertor module

16776257-001† ..... Blank panel, single module width

Thermocouple Compensation Units

Type K (chromel/alumel)† ..... P/N 16778605-001

Type T (copper/constantan)† ..... P/N 16778605-002

Type E (chromel/constantan)† ..... P/N 16778605-003

Type J (iron/constantan)† ..... P/N 16778605-004

Type S (10% rhodium/platinum)† ..... P/N 16778605-005

Type R (13% rhodium/platinum)† ..... P/N 16778605-006

Cable 3 ft. comp. unit to 1858† ..... P/N 16778292-001

Accessories

Latensifier, Model 58L* ..... P/N 16775753-004
usable on 120/240V, 50-60 Hz models only.

Latensifier** ..... P/N 16792616-002
switch selectable 50-60/400 Hz, usable on both 120 and 240V models.

Writing Platen† ..... P/N 16778736-002

14 Channel Add-on Housing** ..... Model 1870

Rack Mounting Kit (1870)† ..... P/N 16779678-001

Rack Mounting Kit (1858)† ..... P/N 16776101-001

Padded Transit Case† ..... P/N 16788279-002
(41858 only)

*U.L. accepted.
**Not submitted for U.L. listing.
†U.L. not applicable.

For 1871 Amplifier Housing information, see D-2488.

Honeywell factory-direct sales and service... from coast to coast

ARIZONA
★ Phoenix (602) 249-7205

CALIFORNIA
★ Los Angeles (213) 726-6000
★ San Francisco (415) 957-2500
★ San Jose (408) 998-3131
☆ San Jose (408) 998-3090
☆ Van Nuys (213) 786-6410

COLORADO
★ Denver (303) 771-2340
☆ Denver (303) 771-4700

FLORIDA
★★ Orlando (305) 894-3131
☆ Plantation (305) 584-7556

GEORGIA
★ Atlanta (404) 321-2524
☆ Atlanta (404) 321-2526

HAWAII
★ Honolulu (808) 845-2991

ILLINOIS
☆ Chicago (312) 777-9095
★ Lansing (312) 474-9300
★ Skokie (312) 674-9770

MARYLAND
★★ Lutherville (301) 828-0900

MASSACHUSETTS
★ Bedford (617) 275-2630
☆ Billerica (617) 667-8351

MICHIGAN
★★ Farmington Hills (313) 478-1600
★ Southfield (313) 424-3500

MINNESOTA
★ Minneapolis (612) 830-3500

MISSOURI
★★ St. Louis (314) 878-2400

NEW JERSEY
☆ Haddon Heights (609) 546-0144
★★ Westfield (201) 233-9200

NEW MEXICO
★ Albuquerque (505) 345-1656

NEW YORK
★ Albany (518) 456-7000
☆ Albany (518) 869-5005
★ Elmsford (201) 233-9200

NORTH CAROLINA
☆ Greensboro (919) 292-1556
★ Raleigh (919) 787-0170

OHIO
☆ Cleveland (216) 433-4810
★ Cleveland (216) 361-7011
★ Dayton (513) 461-4480
☆ Fairborn (513) 461-4480

OREGON
☆ Portland (503) 235-8411

PENNSYLVANIA
★ Bala Cynwyd (215) 835-2500
☆ Camp Hill (717) 737-2063
☆ Philadelphia (215) 387-4510
★ Pittsburgh (412) 922-4422

TENNESSEE
☆ Memphis (901) 345-6222

TEXAS
★ Dallas (214) 387-5322
☆ Dallas (214) 387-5300
★★ Houston (713) 785-3200

VIRGINIA
★ McLean (703) 790-3000
☆ Springfield (703) 321-8356

WASHINGTON
★★ Seattle (206) 233-2000

★ Sales ☆ Metrology

...Across Canada: Honeywell Controls Limited

Head Office and Factory: Scarborough, Ontario

ONTARIO
Hamilton
London
Ottawa
Sudbury
Toronto
Windsor

NOVA SCOTIA
Halifax

QUEBEC
Montreal
Sherbrooke

ALBERTA
Calgary
Edmonton

MANITOBA
Winnipeg

SASKATCHEWAN
Regina
Saskatoon

BRITISH COLUMBIA
Vancouver

NEW BRUNSWICK
Moncton

NEWFOUNDLAND
St. John's

...and around the world: International Subsidiaries and Affiliates

Argentina
Austria
Belgium
Brazil
Denmark
Finland
France
Germany
Great Britain
Hong Kong
India
Iran
Italy
Jamaica
Japan
Jordan
Kuwait
Mexico
Netherlands
New Zealand
Norway
South Africa
Spain
Sweden
Switzerland
Taiwan
Venezuela

Distributors

Australia
Chile
Colombia
Fiji
Greece
Iceland
Indonesia
Korea
Malaysia
Pakistan
Peru
Philippine Islands
Portugal
Singapore
Thailand
Turkey
Arab Republic of Egypt
West Indies
Yugoslavia

We'll show you a better way.

Contact your nearest Honeywell Sales Engineer today for a demonstration. Your purchase from Honeywell includes an interest that extends beyond the sale. Nationwide metrology service provides repair and calibration for all Honeywell instrumentation.

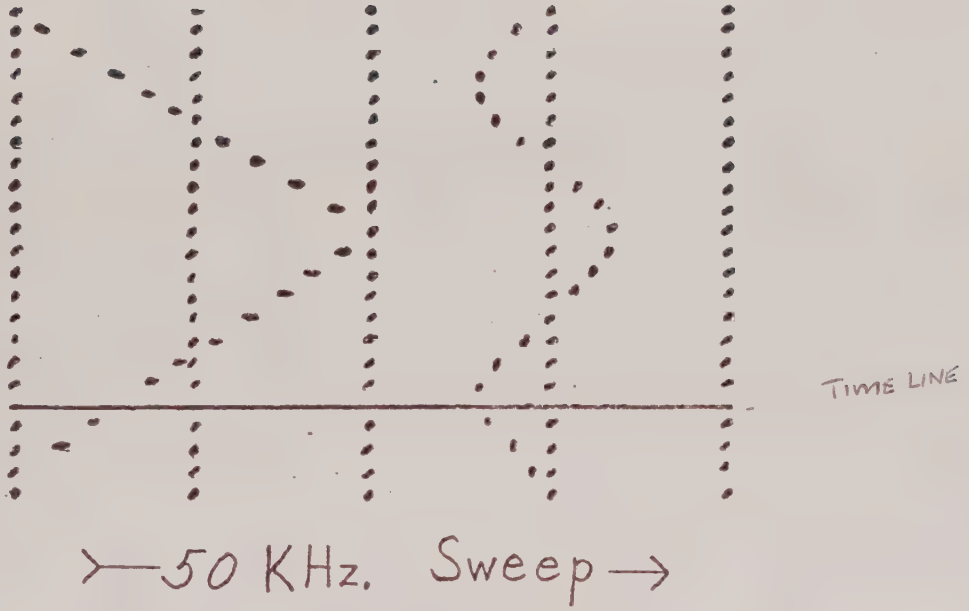
Honeywell

Honeywell Test Instruments Division • Post Office Box 5227 • Denver, Colorado 80217 • (303) 771-4700

Specifications subject to change without notice.

Printed in U.S.A. 1277 D-2473F

0.1μs Turn-on time.
Flyback 20μs



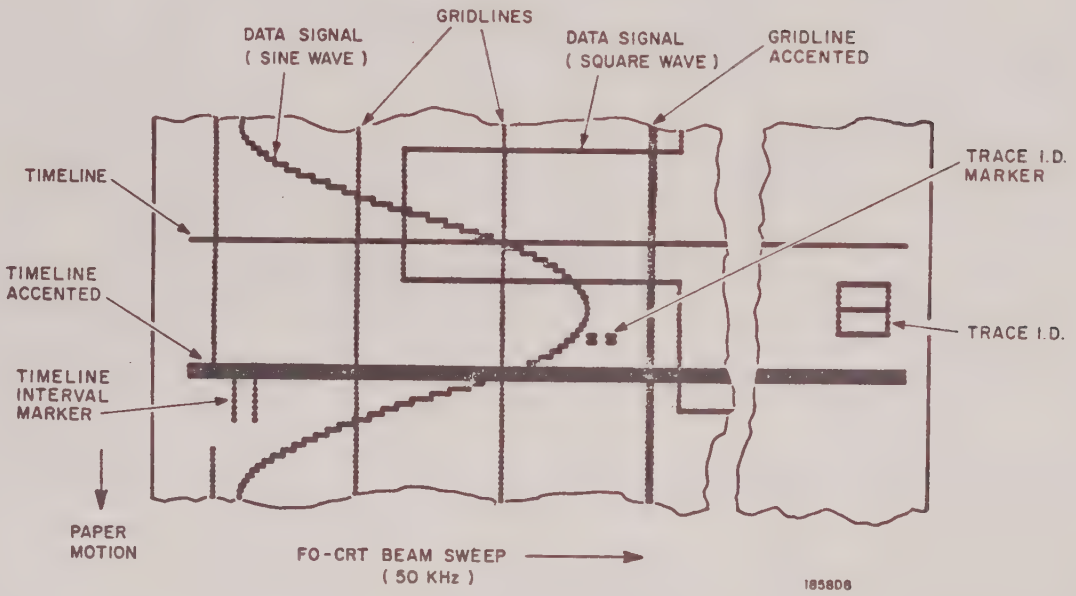
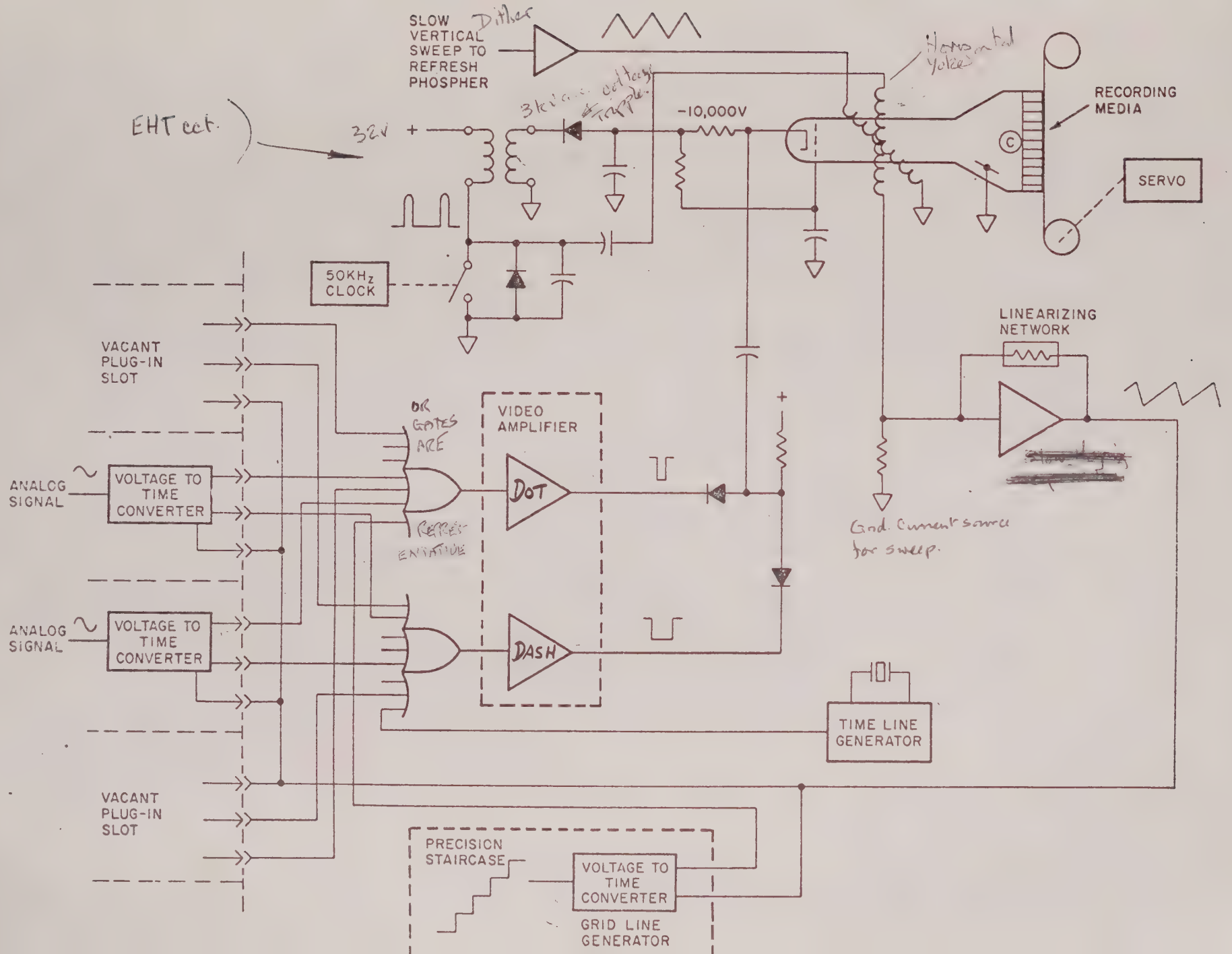
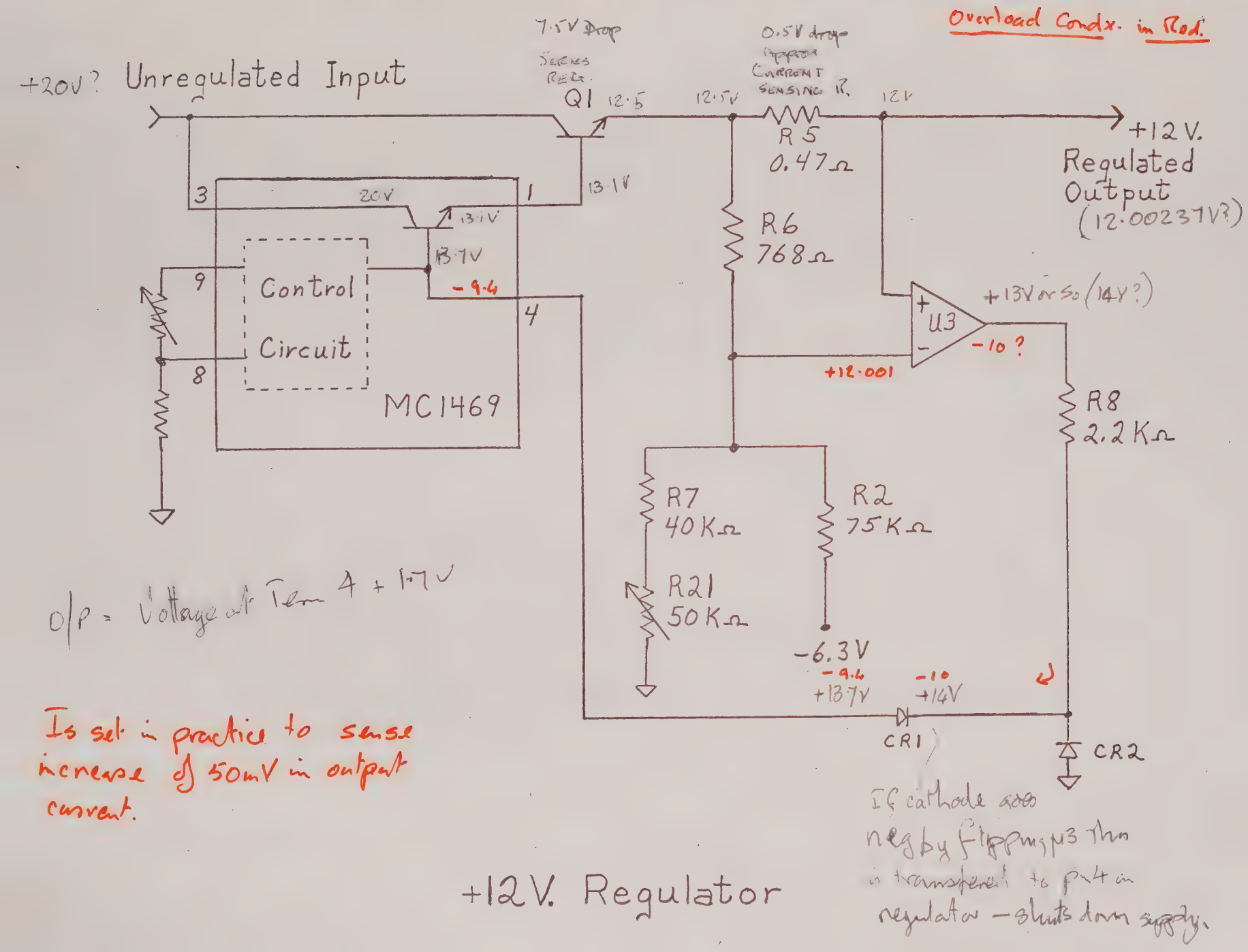


Figure 4-2. Magnified Section of a Model 1858 Recording

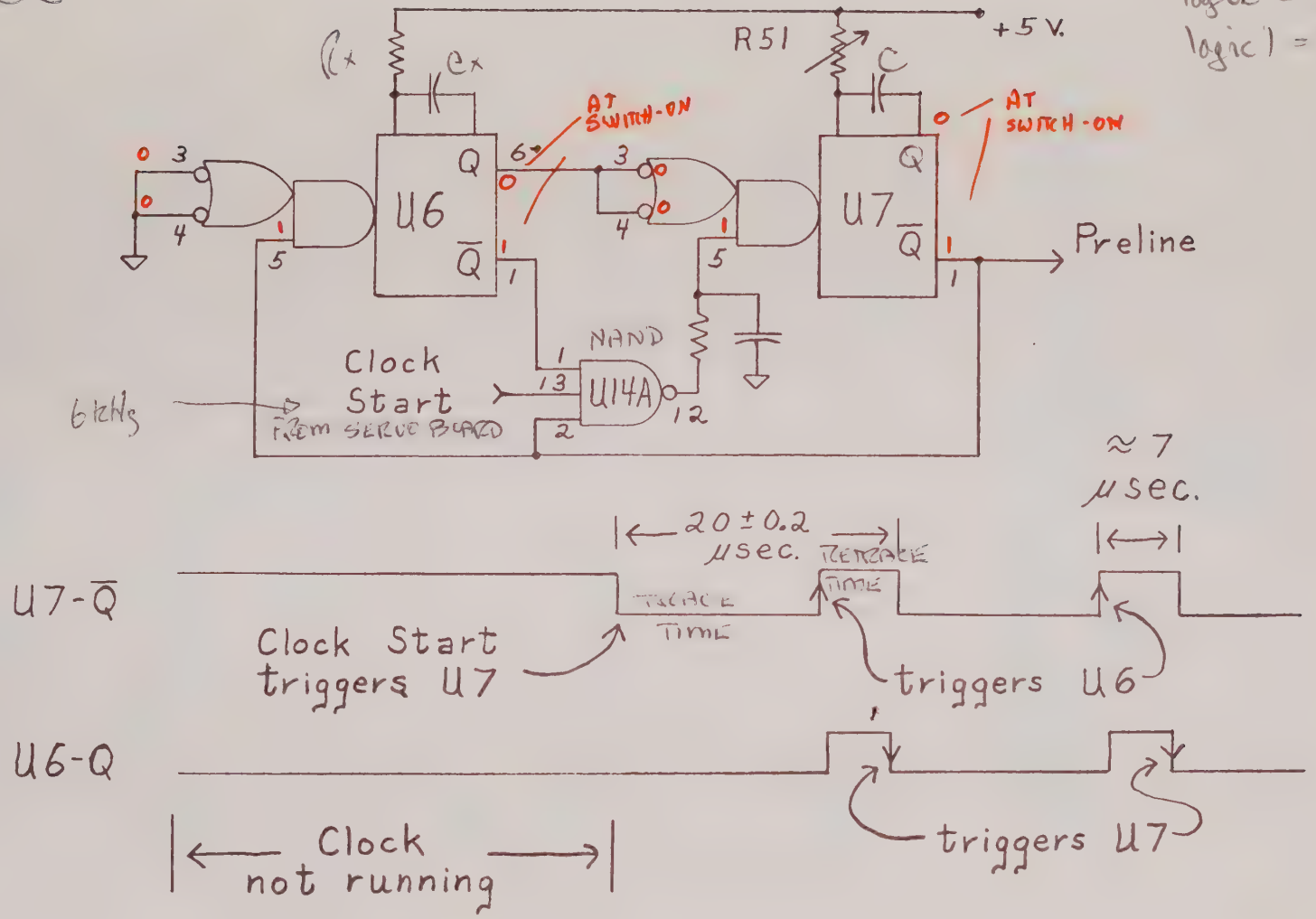

SLOW VERTICAL SWEEP TO REFRESH PHOSPHER
Dither
EHT ect.
32V
-10,000V
RECORDING MEDIA
SERVO
50KHz CLOCK
VACANT PLUG-IN SLOT
LINEARIZING NETWORK
OR GATES ARE
VIDEO AMPLIFIER
ANALOG SIGNAL
VOLTAGE TO TIME CONVERTER
DOT
DASH
TIME LINE GENERATOR
PRECISION STAIRCASE
GRID LINE GENERATOR


Overload Condx. in Rod.
+20V? Unregulated Input
7.5V Drop
Series Reg.
Q1
12.5
12.5V
0.5V drop
Approx
Current
Sensing R.
12V
R5
0.47Ω
+12 V.
Regulated
Output
(12.00237V?)
13.1V
3
20V
1
13.1V
13.7V
-9.4
9
Control
Circuit
8
4
MC1469
R6
768Ω
+13V or So (14V?)
U3
-10?
+12.001
R8
2.2KΩ
R7
40KΩ
R2
75KΩ
R21
50KΩ
-6.3V
-9.4
+13.7V
-10
+14V
CR1
CR2
O/P = Voltage at Term 4 + 1.7V
Is set in practice to sense increase of 50mV in output current.
If cathode goes negby flipping U3 this is transferred to pin 4 in regulator — shuts down supply.
+12V. Regulator

Master Clock

20μs

logic 0 = 0V
logic 1 = +5V



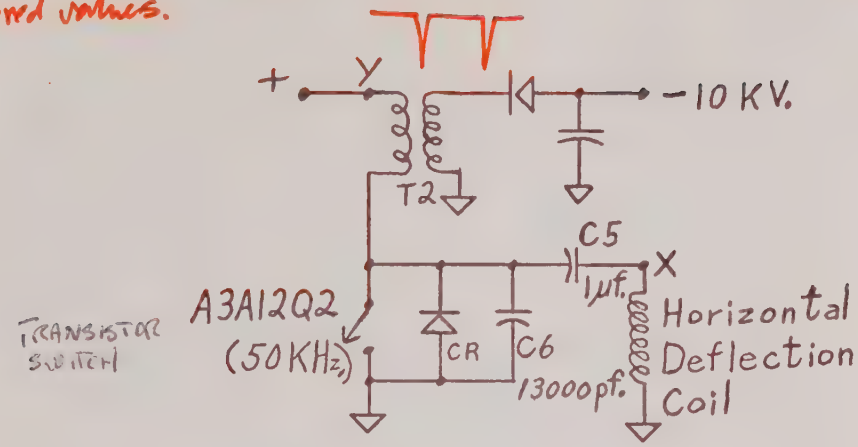
Brown fig. 7.2

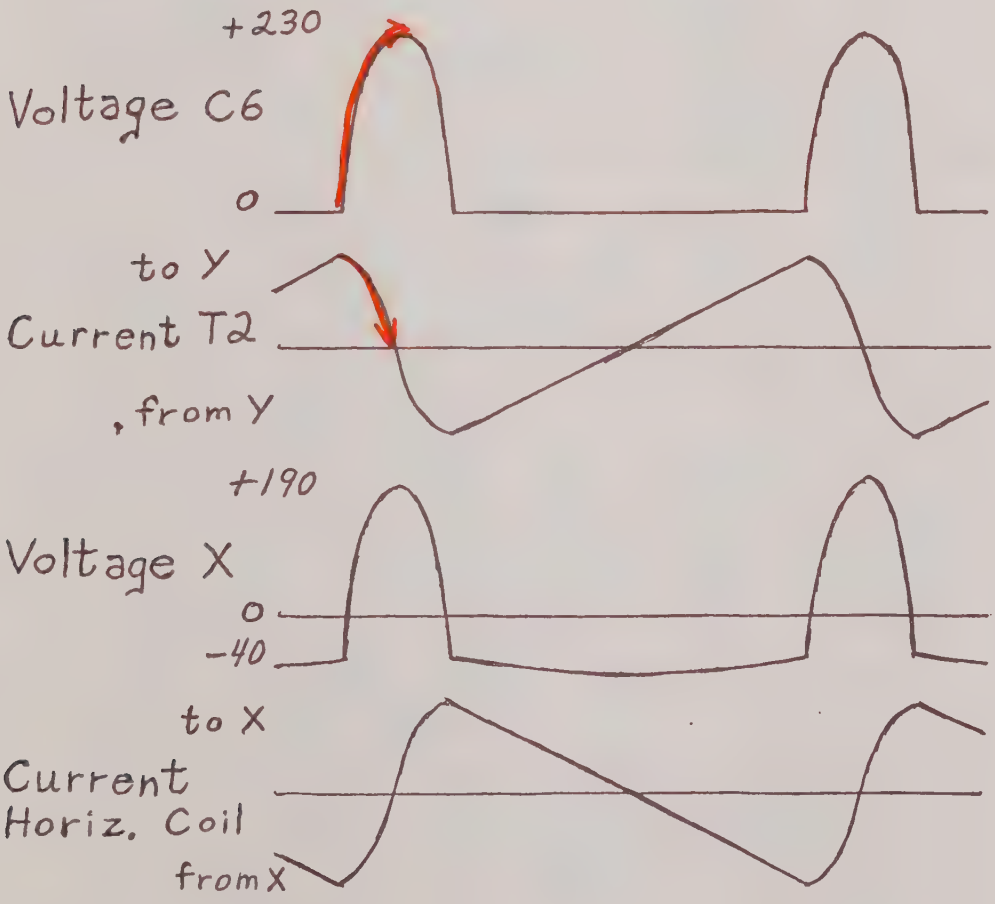
1858 Preline Generator

(50 KHz. Clk.)

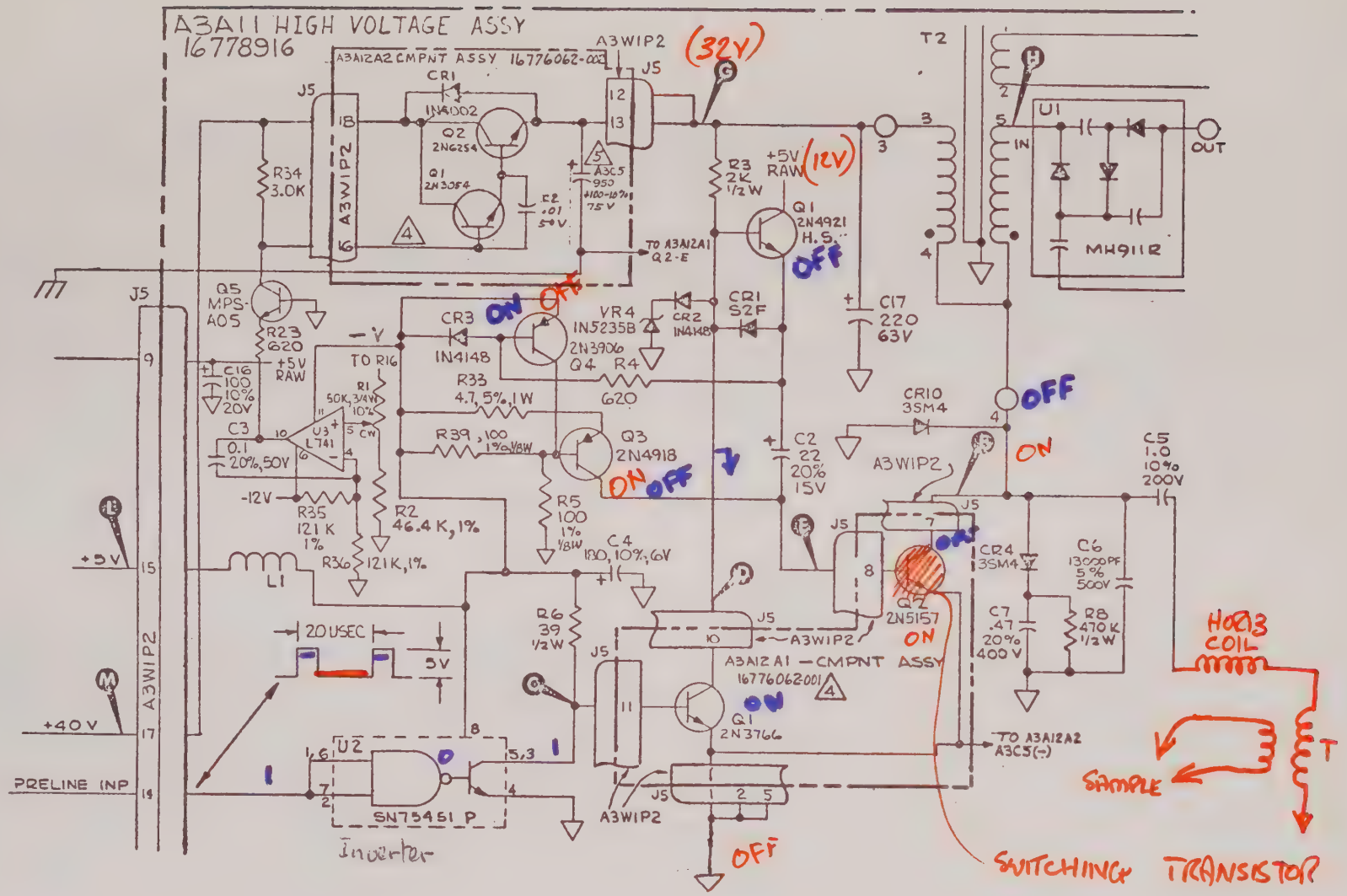
As This is a resonant ckt
Do NOT replace any compts
with altered values.

C6 Resonates with
Primary of T2.

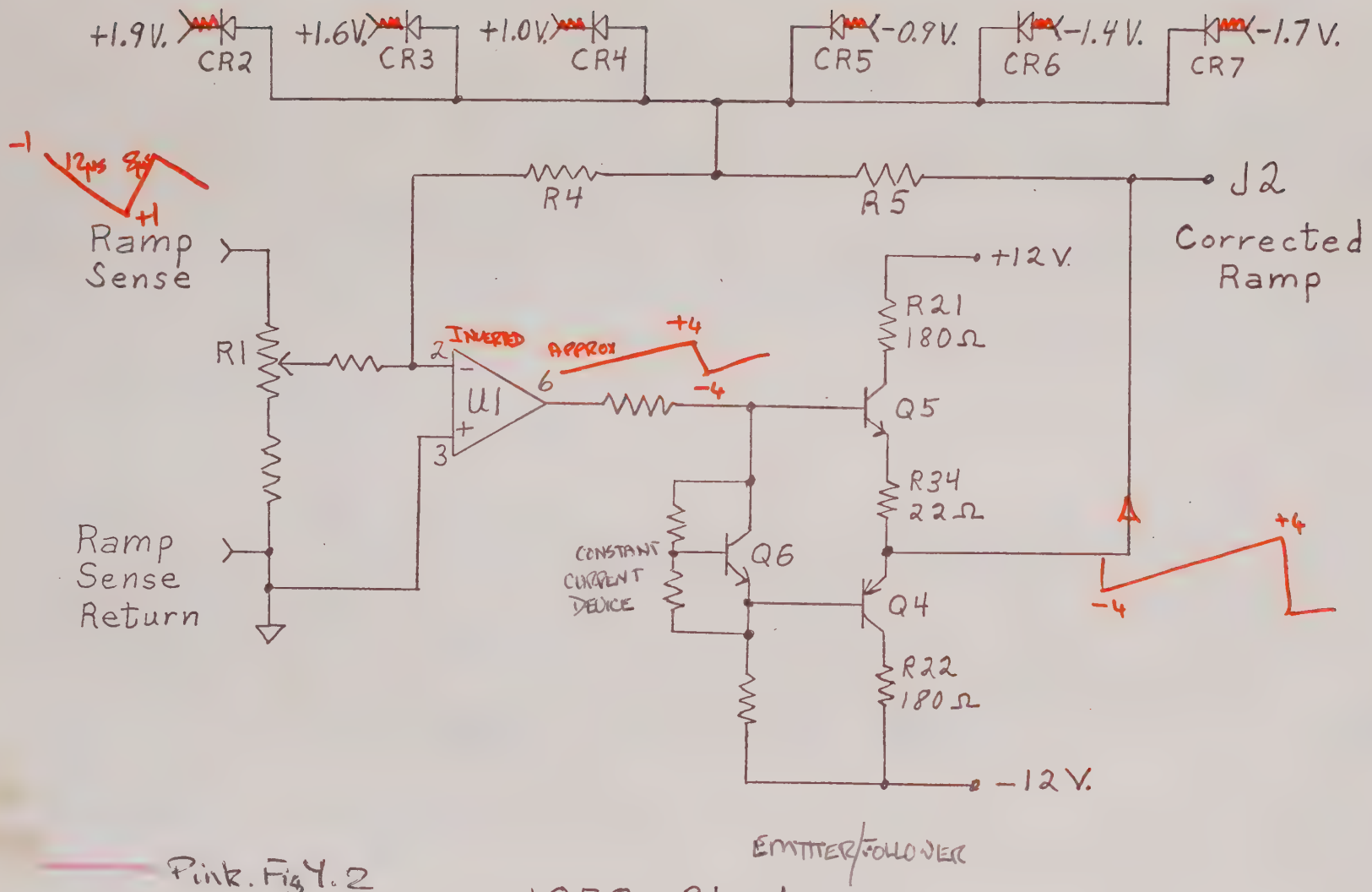




1858 Horizontal Sweep
and High Voltage

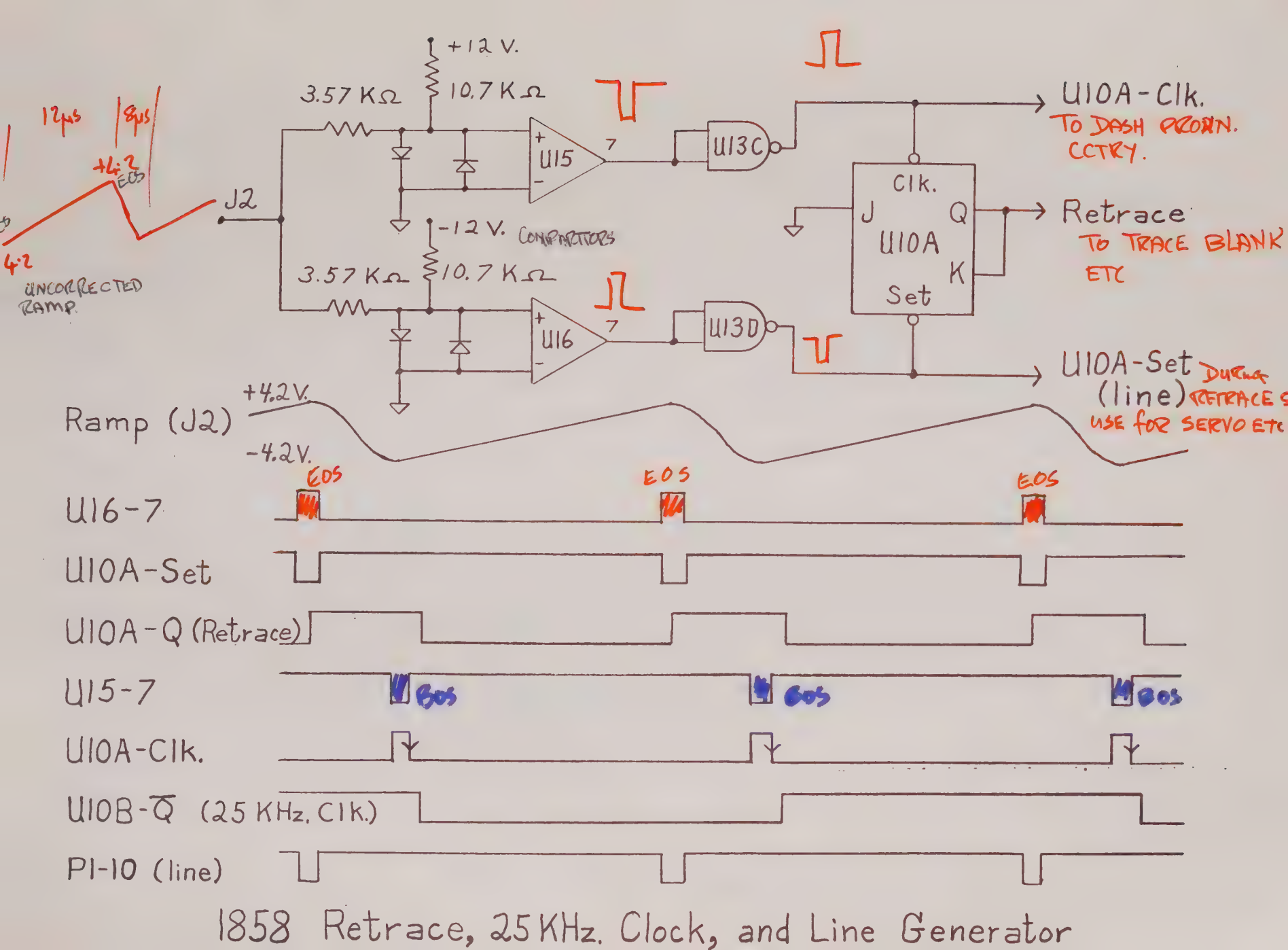


1858 High Voltage
50 kHz. Switching

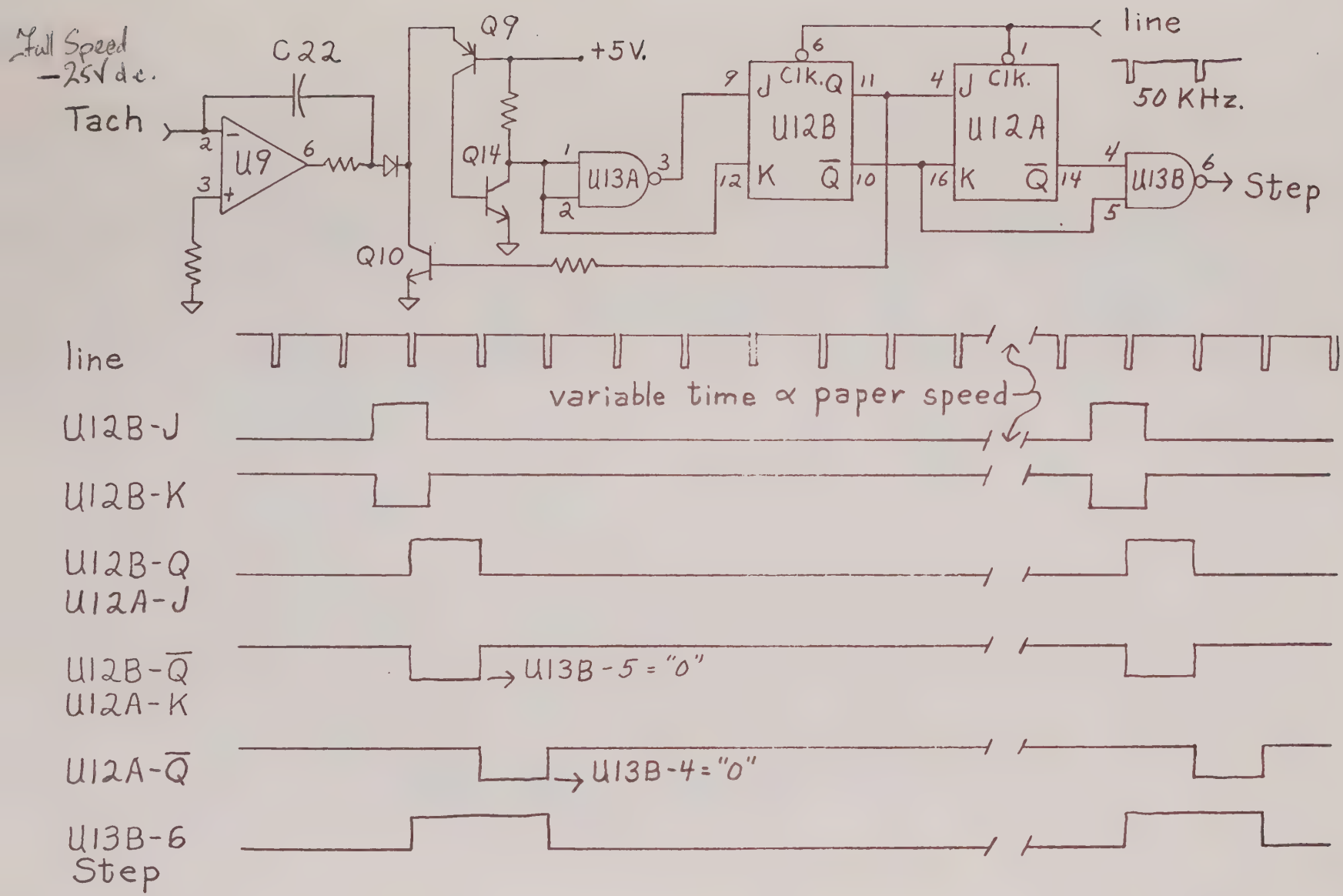


Pink. Fig Y. 2

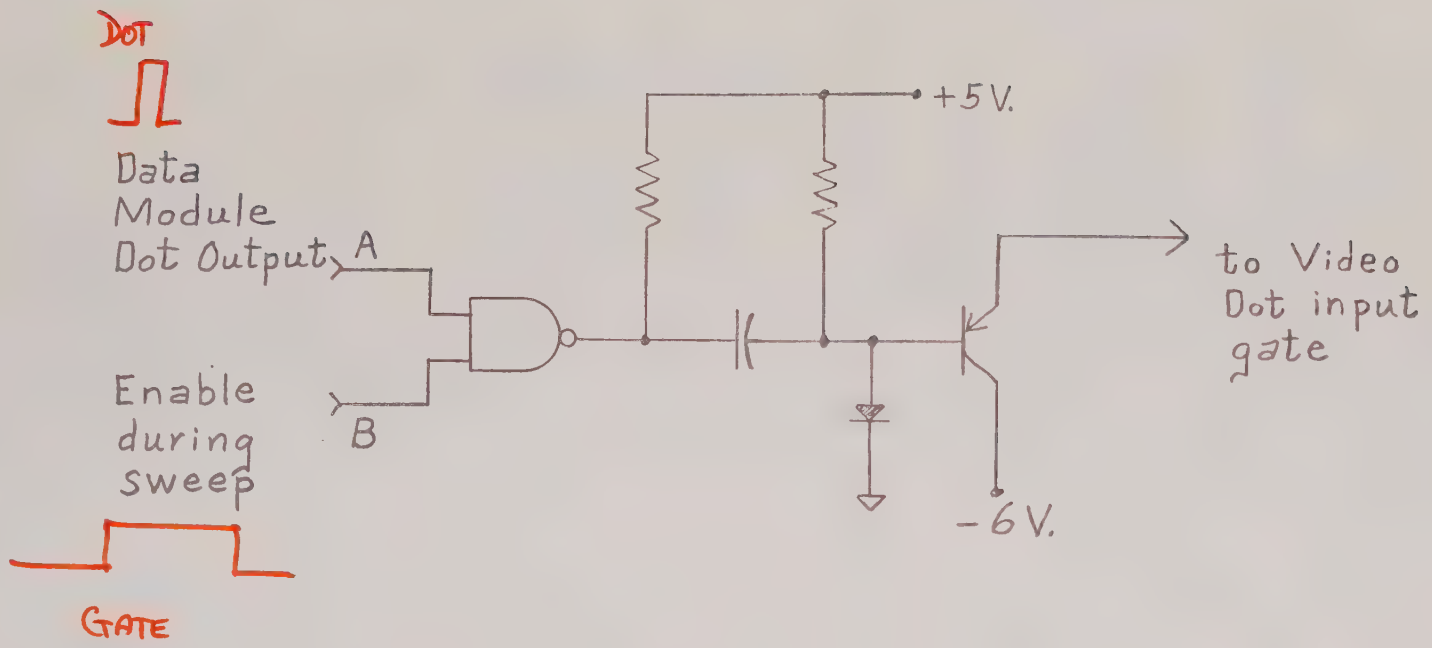
1858 Clock Ramp Amplifier



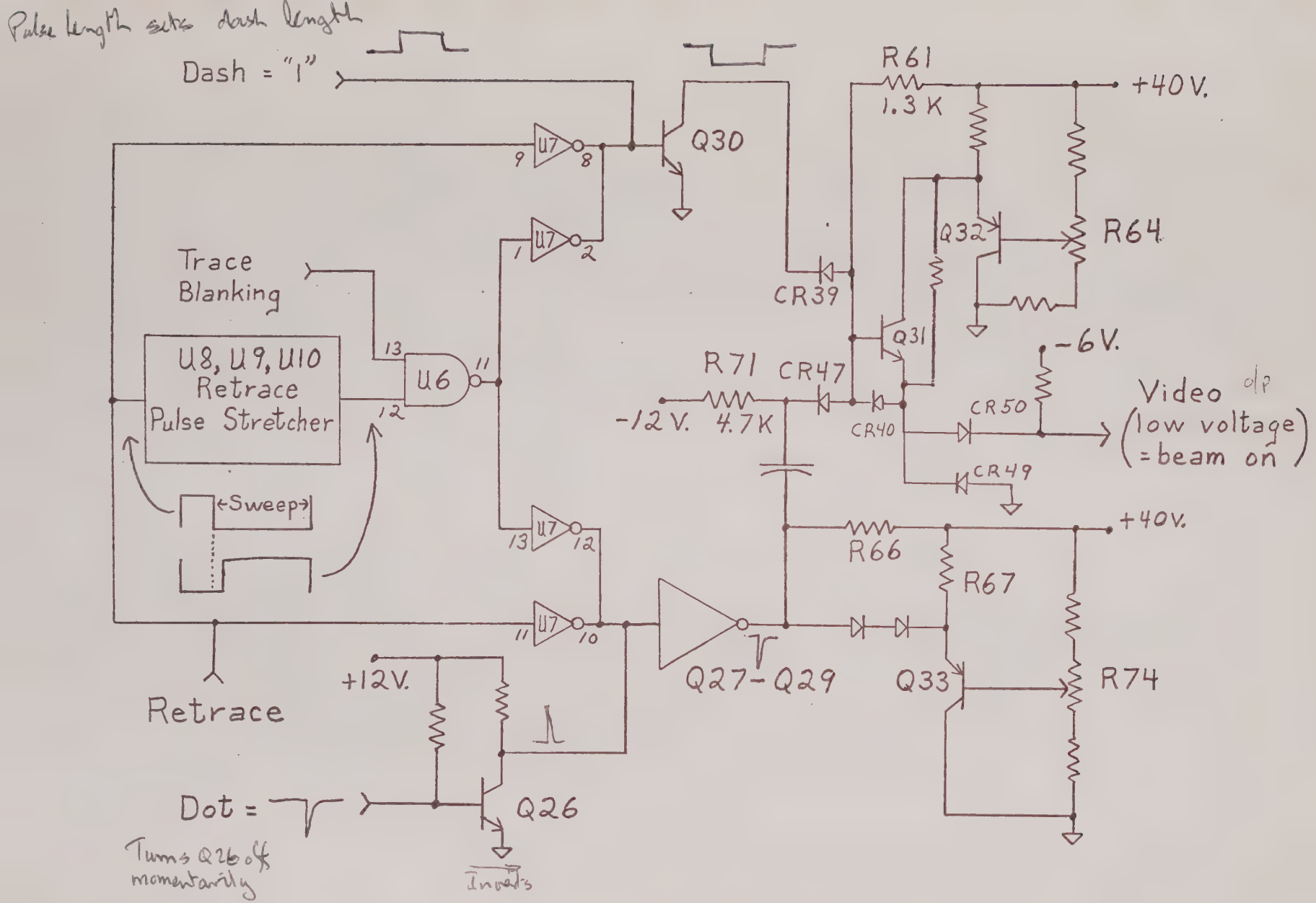
1858 Retrace, 25 KHz. Clock, and Line Generator



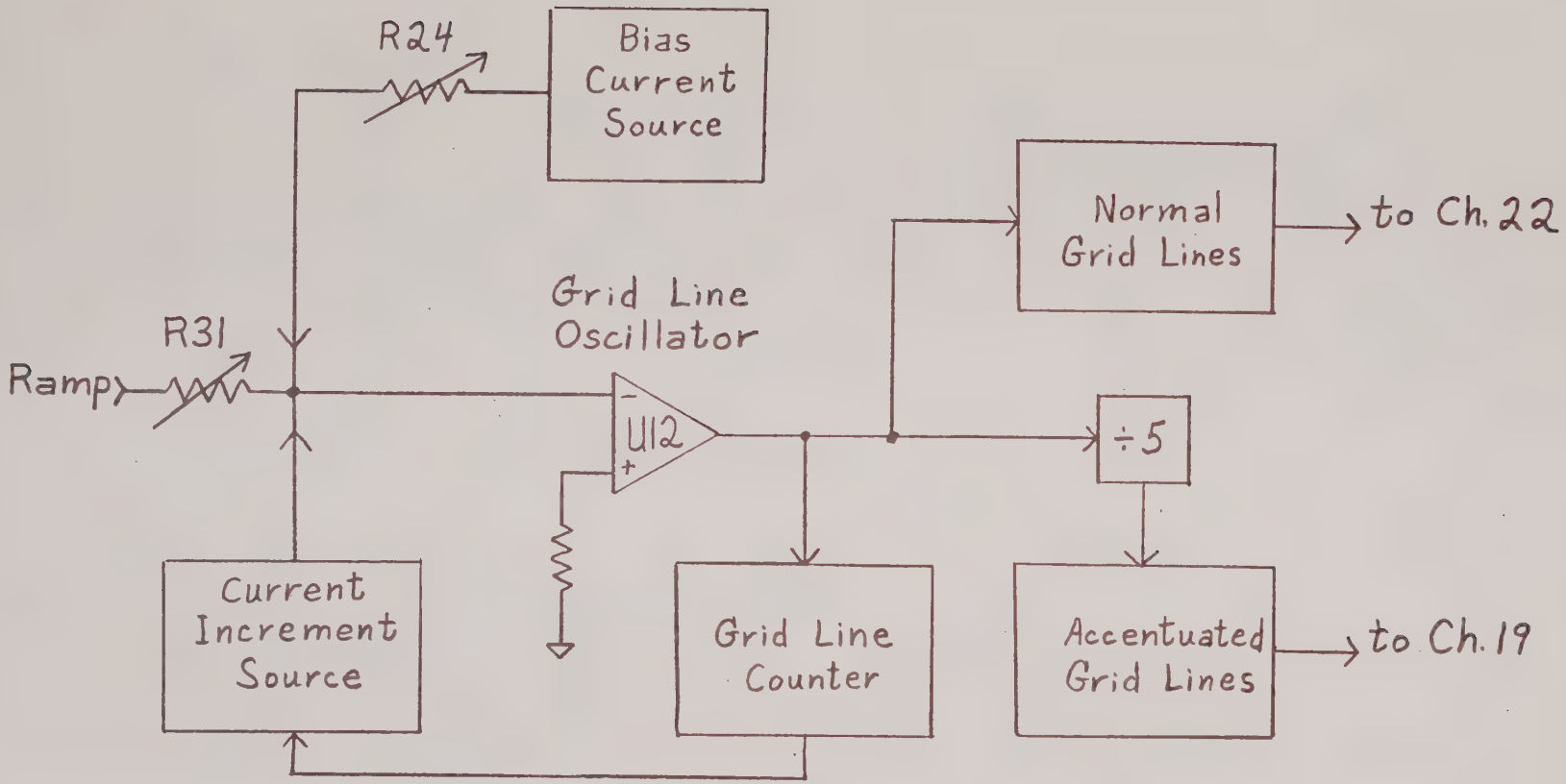
1858 Step Generator



1858 Video Channel Input

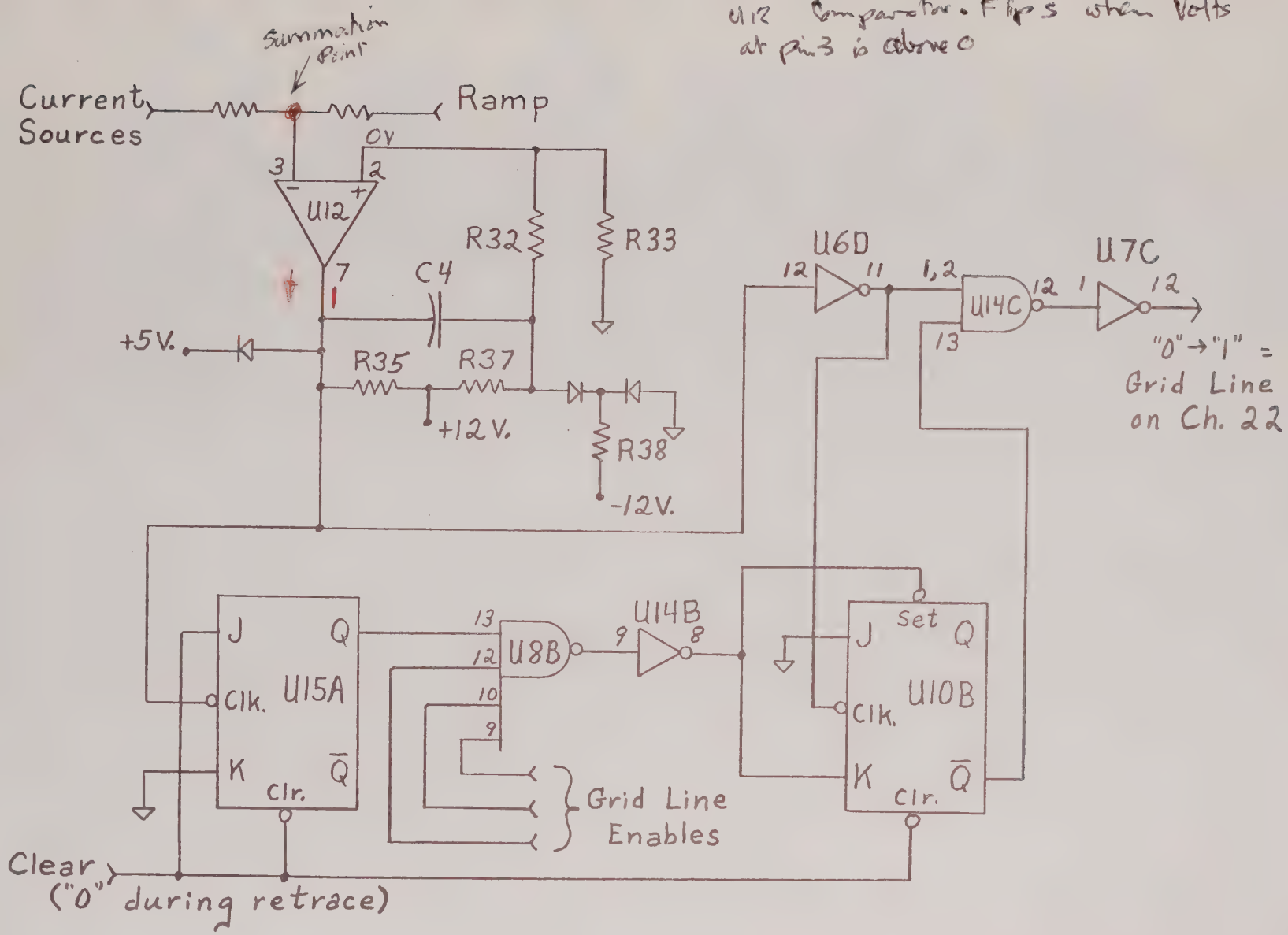


1858 Video Amplifier



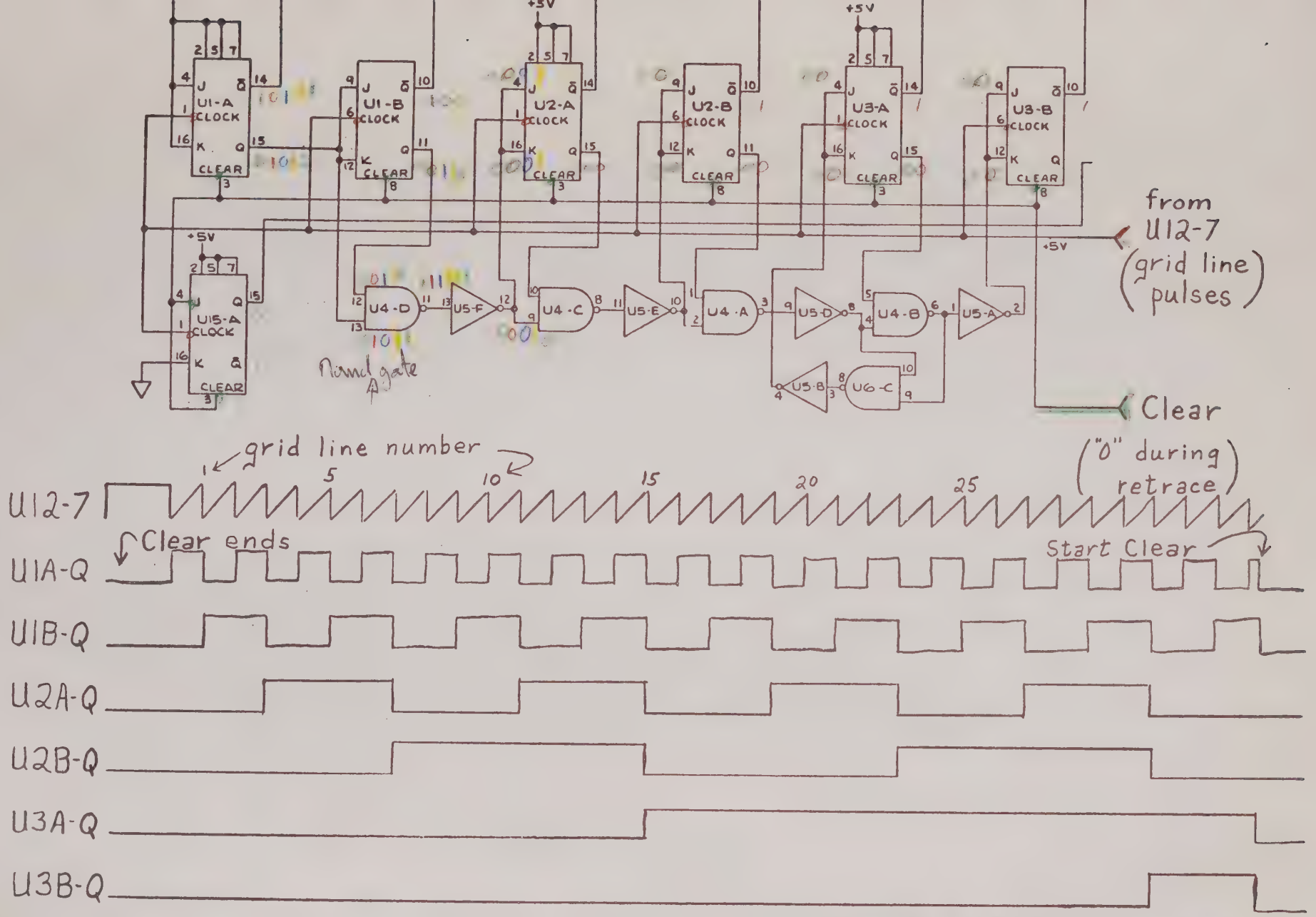
1858 Grid Lines

U12 Comparator. Flips when Volts at pin 3 is above 0



1858 Gridlines

Gridline Oscillator



1858 Gridlines

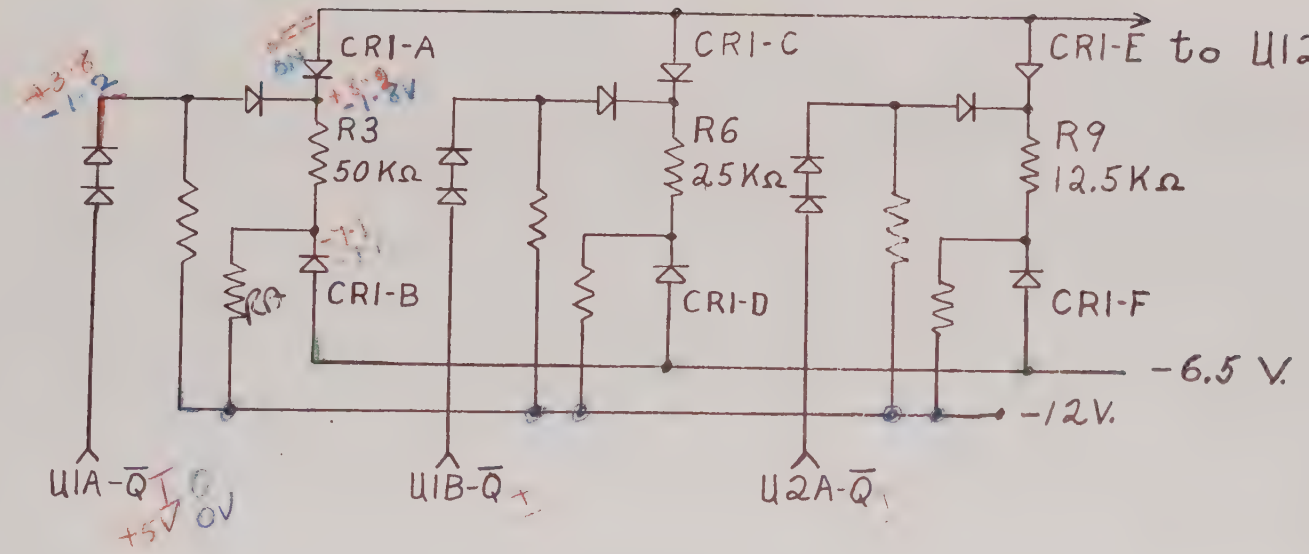
Gridline Counter

Each $\bar{Q}$ controls a current source in a $1\ 2\ 2^2\ 2^3$ relationship. All are at 1 to start (no current).

U12-7 Pulses	U1-A		U1-B		U2-A		Diodes Conducting	Current Units
	JK	Q	JK	Q	JK	Q		
before 1 (clear)	1	0	0	0	0	0		
after 1	1	1	1	0	0	0	CR1-A	1
after 2	1	0	0	1	0	0	CR1-C	2
after 3	1	1	1	1	1	0	CR1-A, CR1-C	3
after 4	1	0	0	0	0	1	CR1-E	4
after 5	1	1	1	0	0	1	CR1-A, CR1-E	5
after 6	1	0	0	1	0	1	CR1-C, CR1-E	6

1858 Gridlines

Gridline Counter Logic Chart



U1A-Q	U1B-Q	U2A-Q	Diodes ON	Current Units
1	0	0	CR1-A	1
0	1	0	CR1-C	2
1	1	0	CR1-A CR1-C	3
0	0	1	CR1-E	4
1	0	1	CR1-A CR1-E	5
0	1	1	CR1-C CR1-E	6

Whenever Q = "1", $\bar{Q}$ = "0" and the associated diode is turned on.

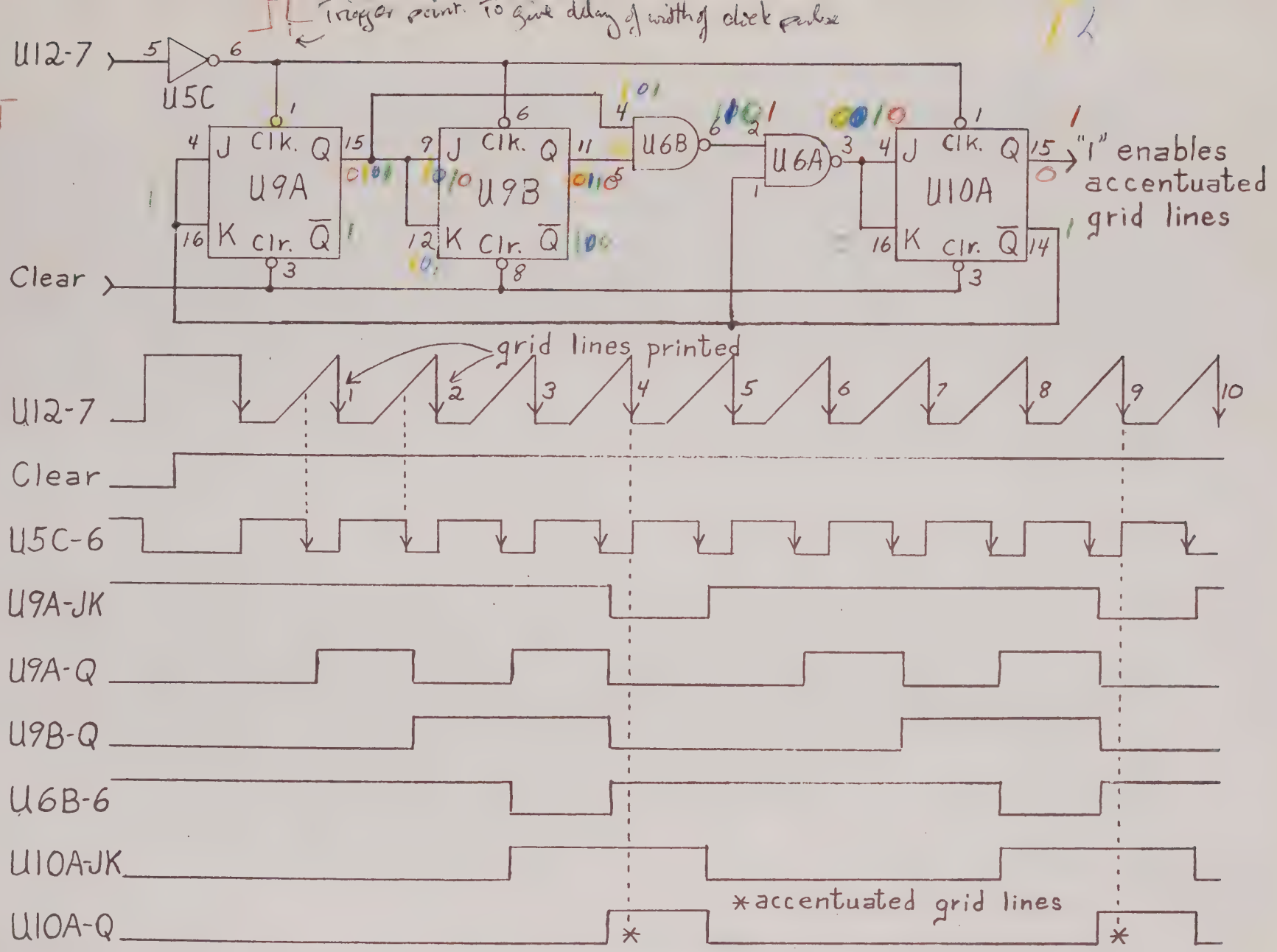
A current unit $\approx \frac{6.5\ V.}{50\ K\Omega}$.

Thus, $\frac{6.5\ V.}{25\ K\Omega}$ = 2 current units, etc.

Divider RA/R3 via CR1-A between −12 & U12-3 gives about 6mA of current.

1858 Gridlines

Current Increment Source

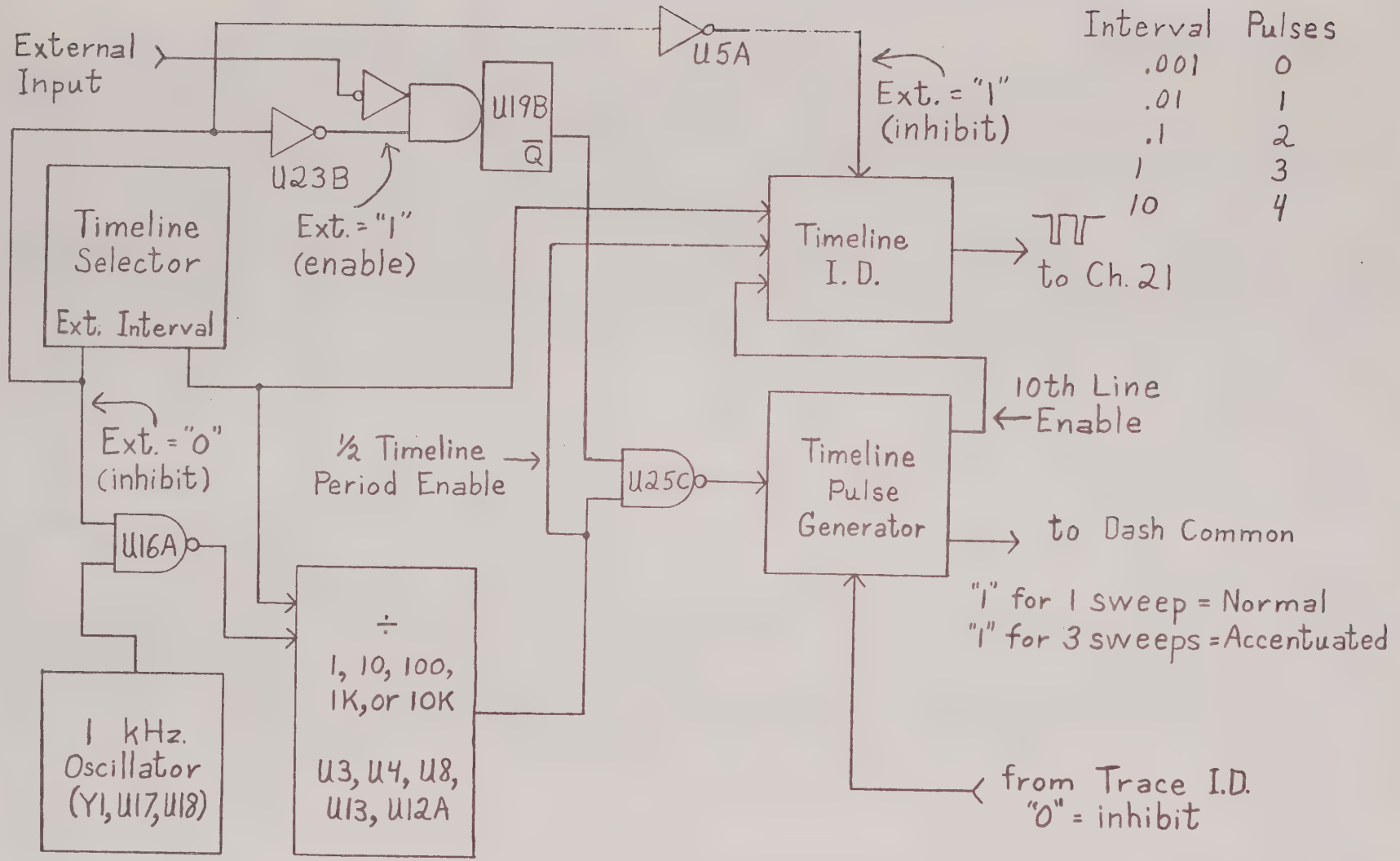


1858 Accentuated Gridlines

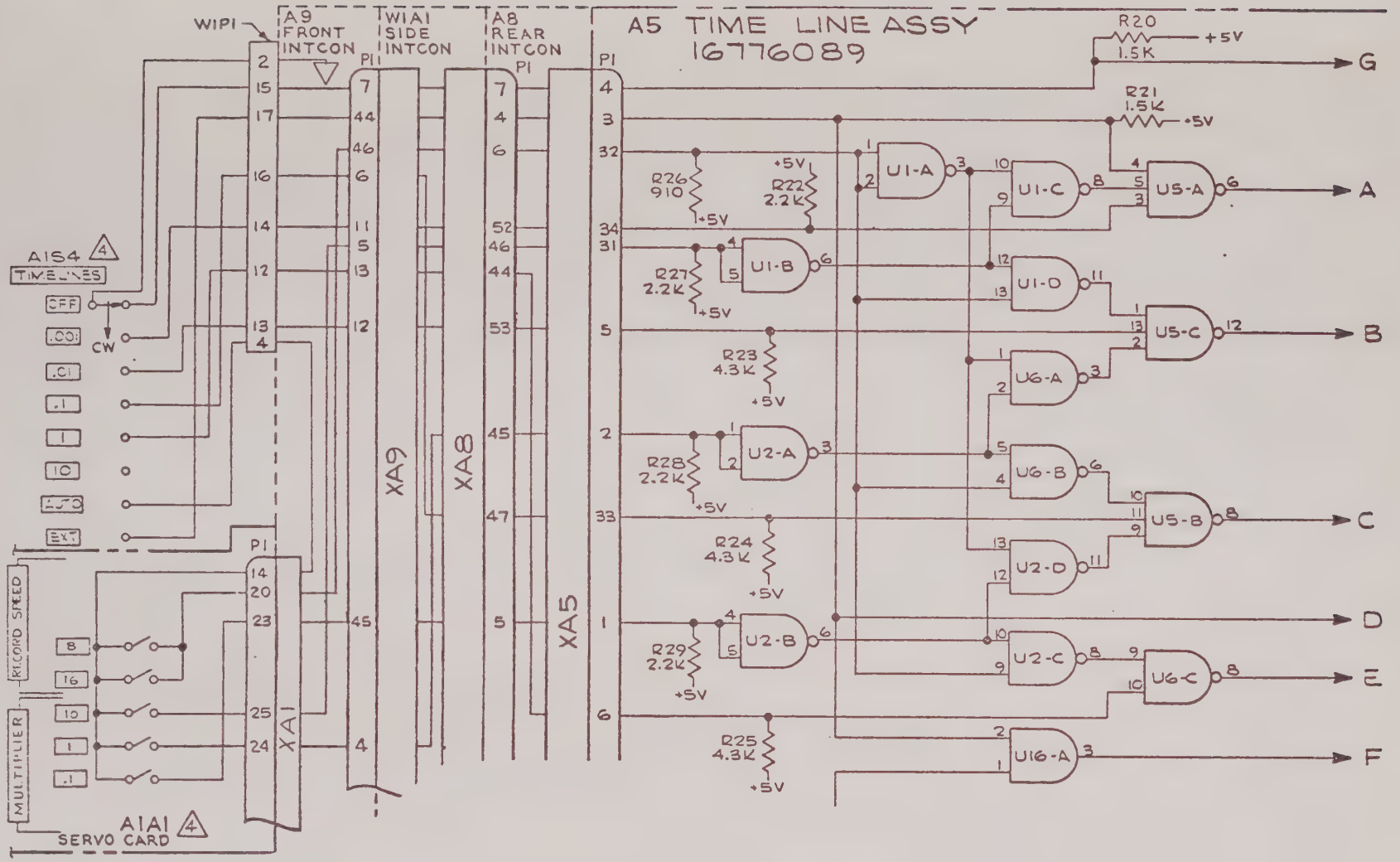
U5C-6 Clk. Pulse	U9A-JK	U9A-Q	U9B-Q	U6B-6	U10A-$\overline{Q}$	U6A-3	U10A-Q	Grid Line
before 1 (clear)	1	0	0	1	1	0	0	
after 1	1	1	0	1	1	0	0	1
after 2	1	0	1	1	1	0	0	2
after 3	1	1	1	0	1	1	0	3
after 4	0	0	0	1	0	1	1	4-Accent
after 5	1	0	0	1	1	0	0	5
after 6	1	1	0	1	1	0	0	6
after 7	1	0	1	1	1	0	0	7
after 8	1	1	1	0	1	1	0	8
after 9	0	0	0	1	0	1	1	9-Accent
after 10	1	0	0	1	1	0	0	10

1858 Gridlines

Accentuated Gridline Logic Chart

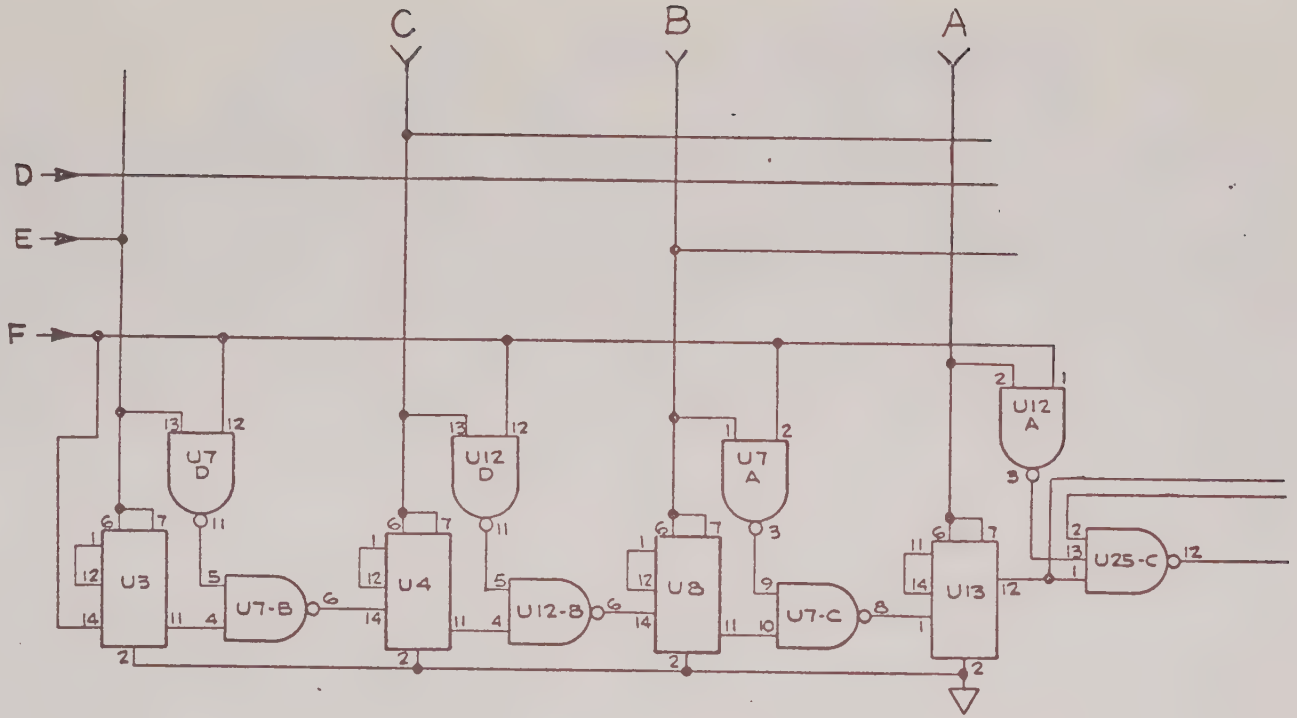


1858 Timelines



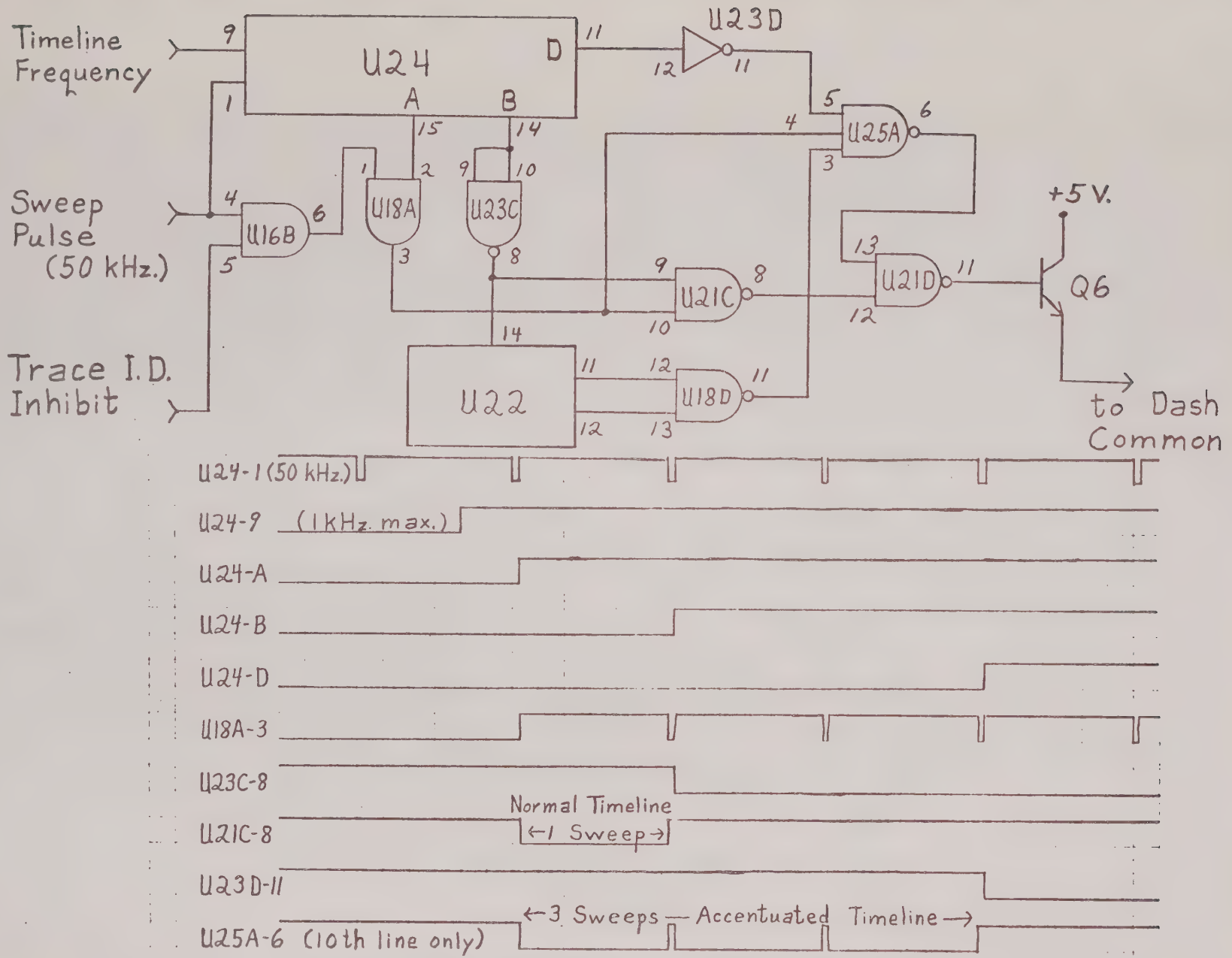
1858 Timeline Generator

Interval Selector

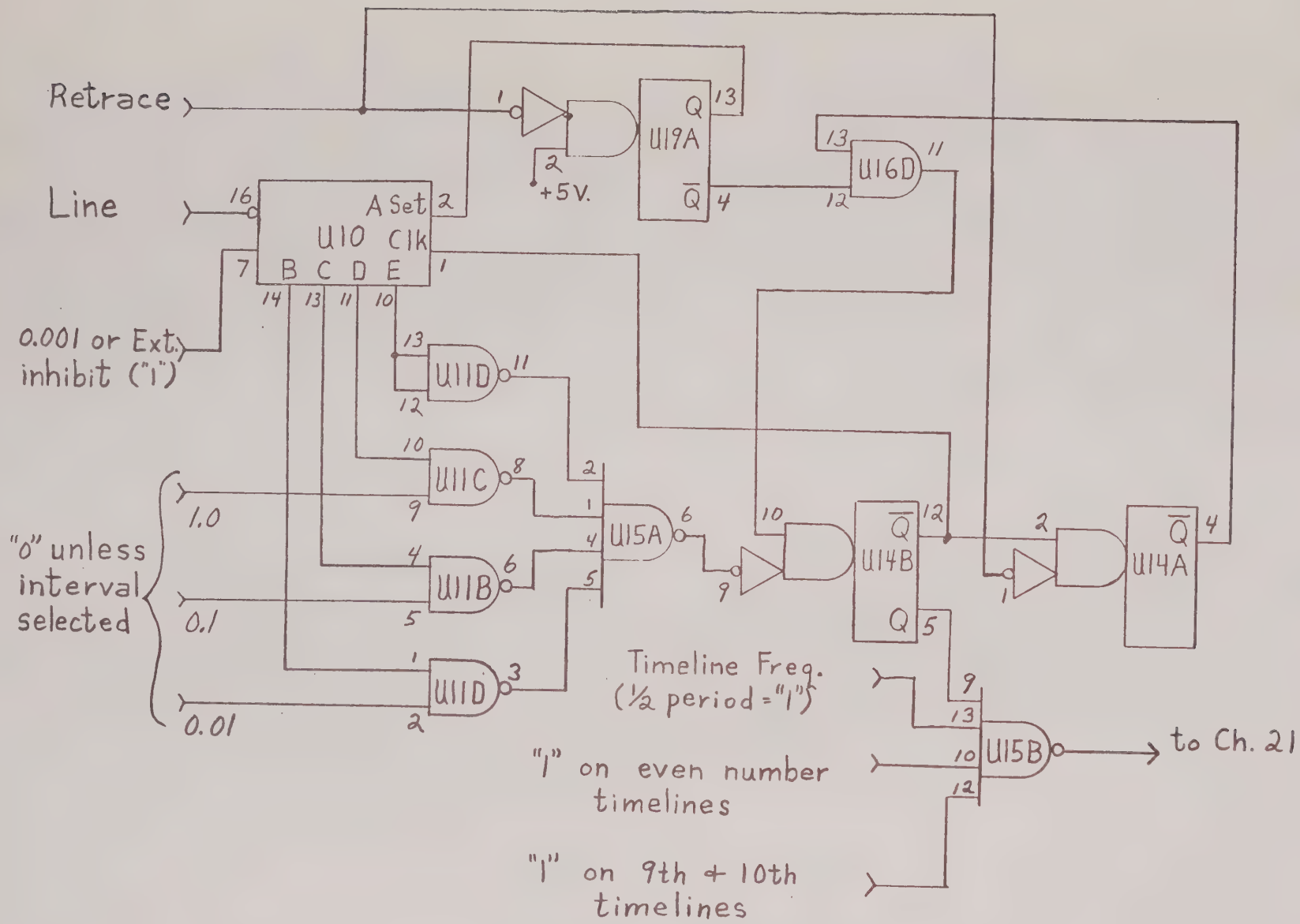


1858. Timeline Generator

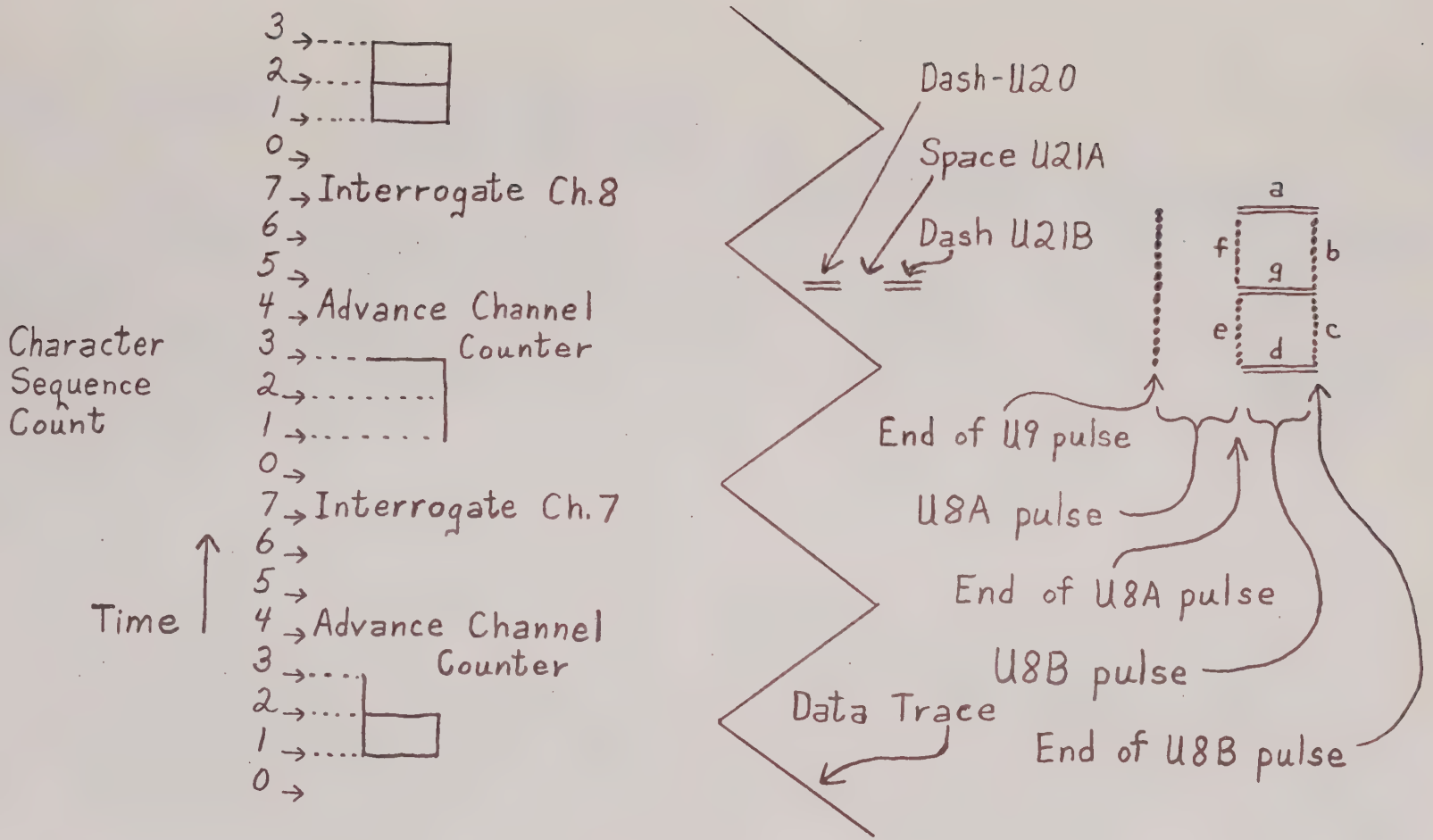
Frequency Divider



1858 Timeline Pulse Generator



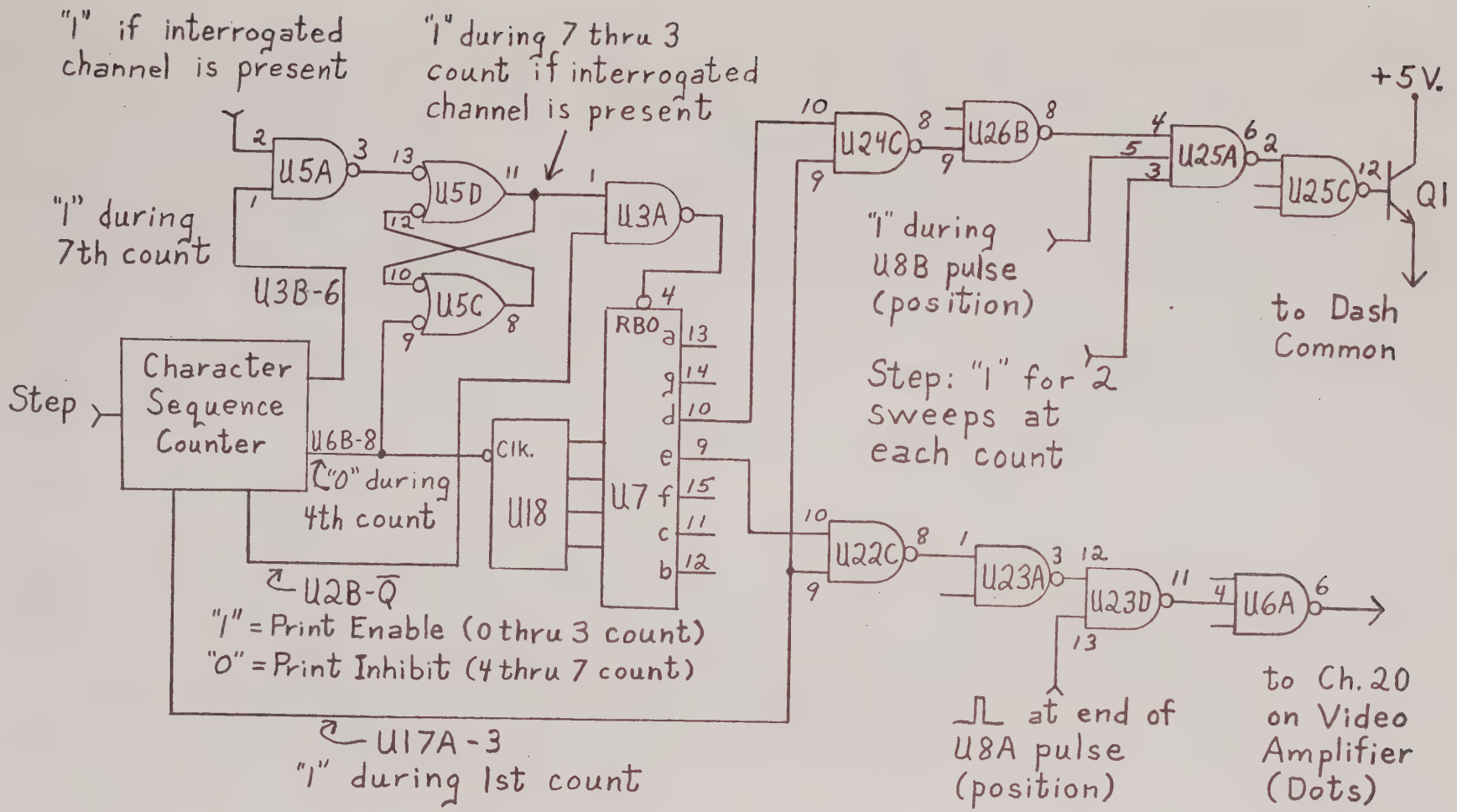
1858 Timeline I. D.



1858 Trace I.D.

Character Formation

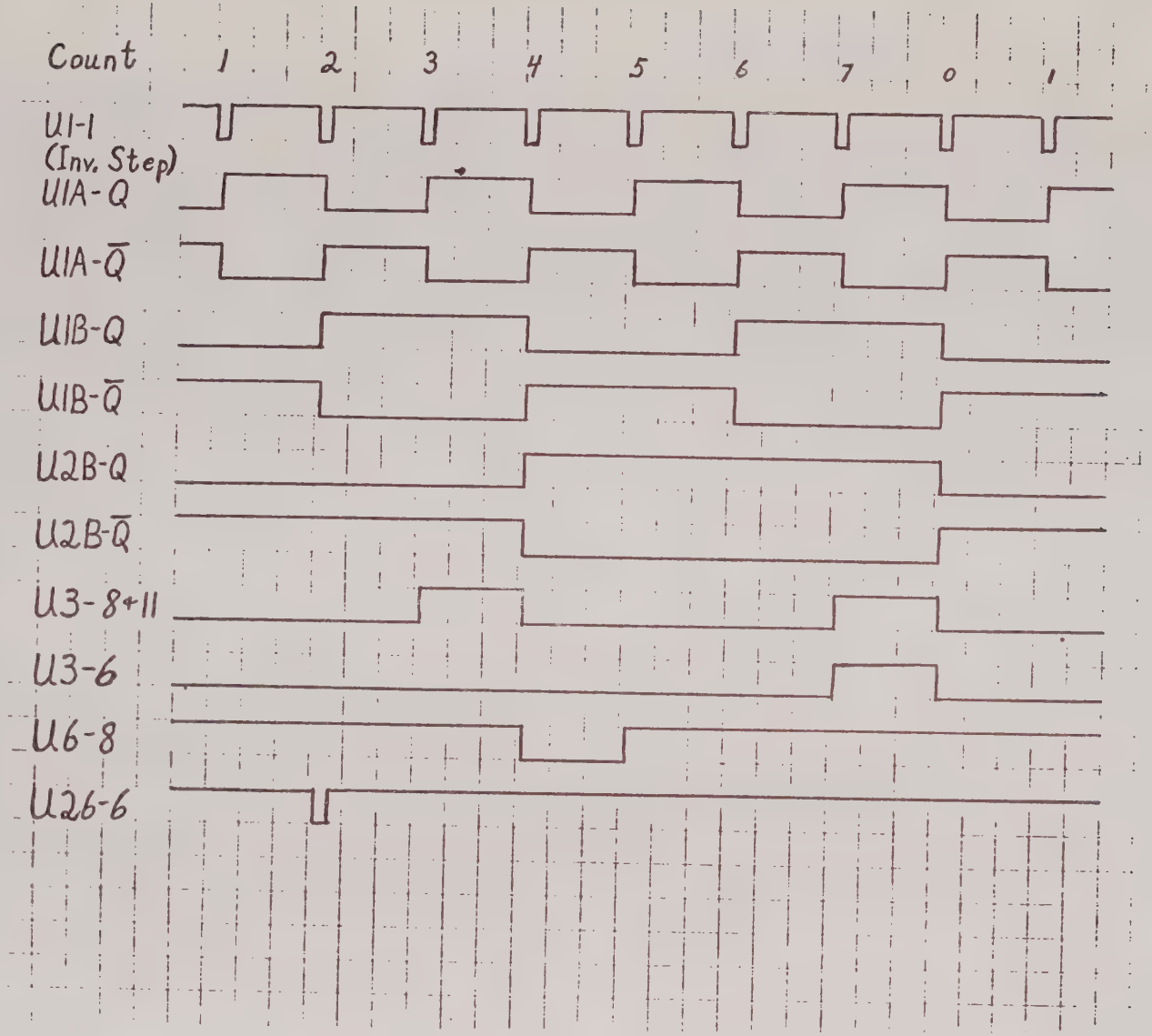
OLD DO GOOD.



1858 Trace I. D.

Character Sequence Counter, Channel Counter, and 7-bar Printer

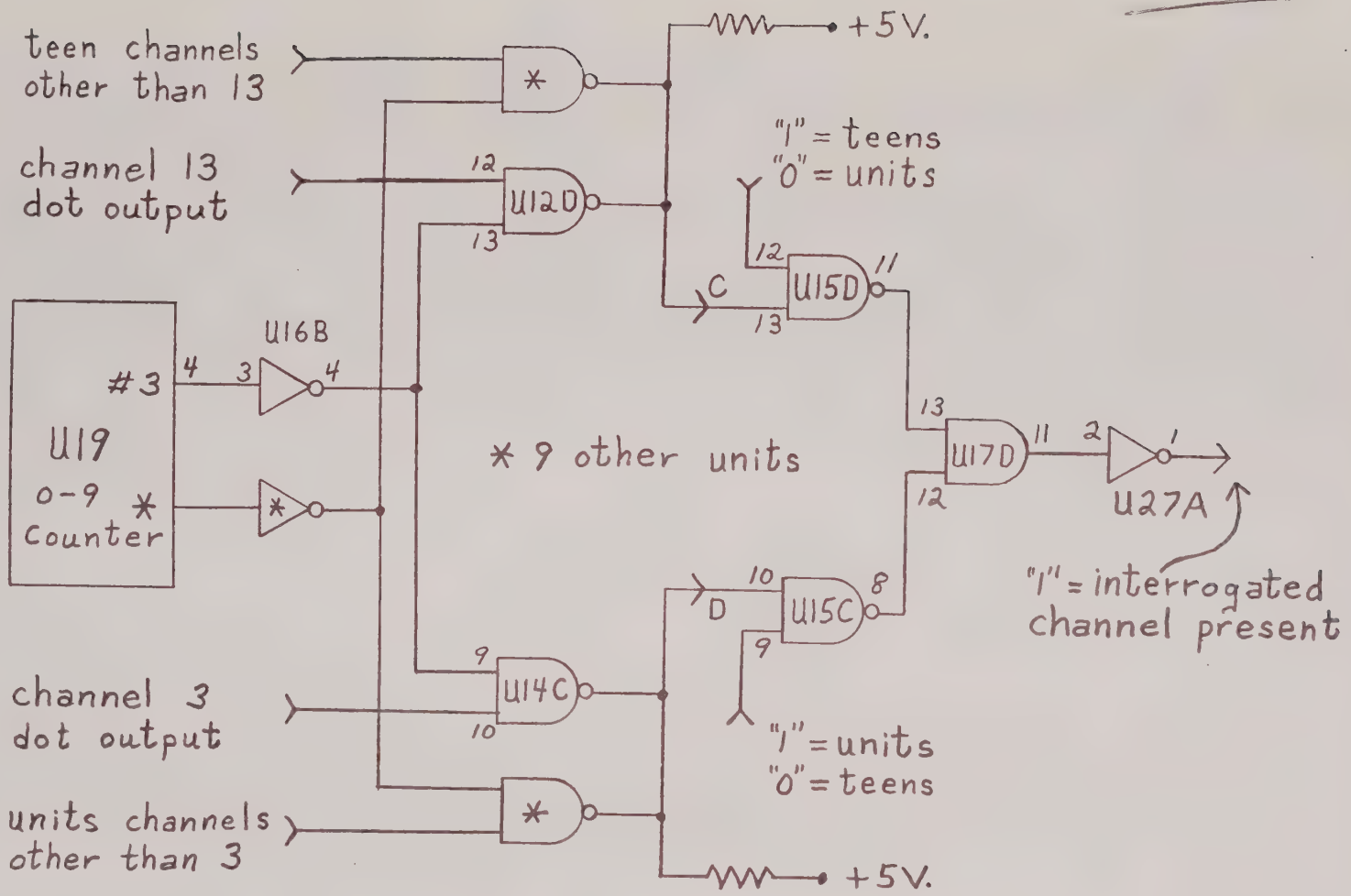
OLD



1858 Trace I.D.

Waveforms

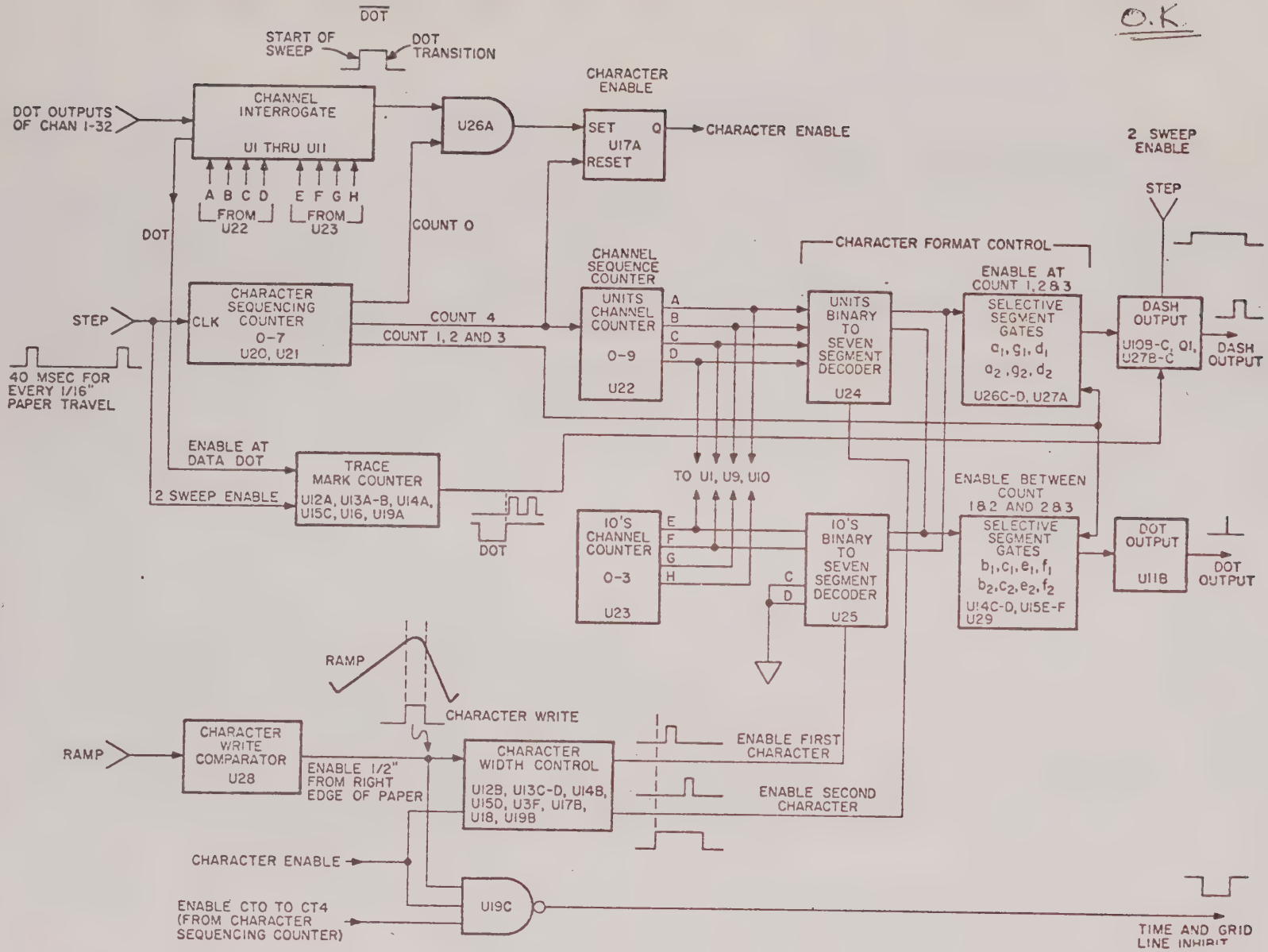
OLD



1858 Trace I.D.

Channel Interrogator

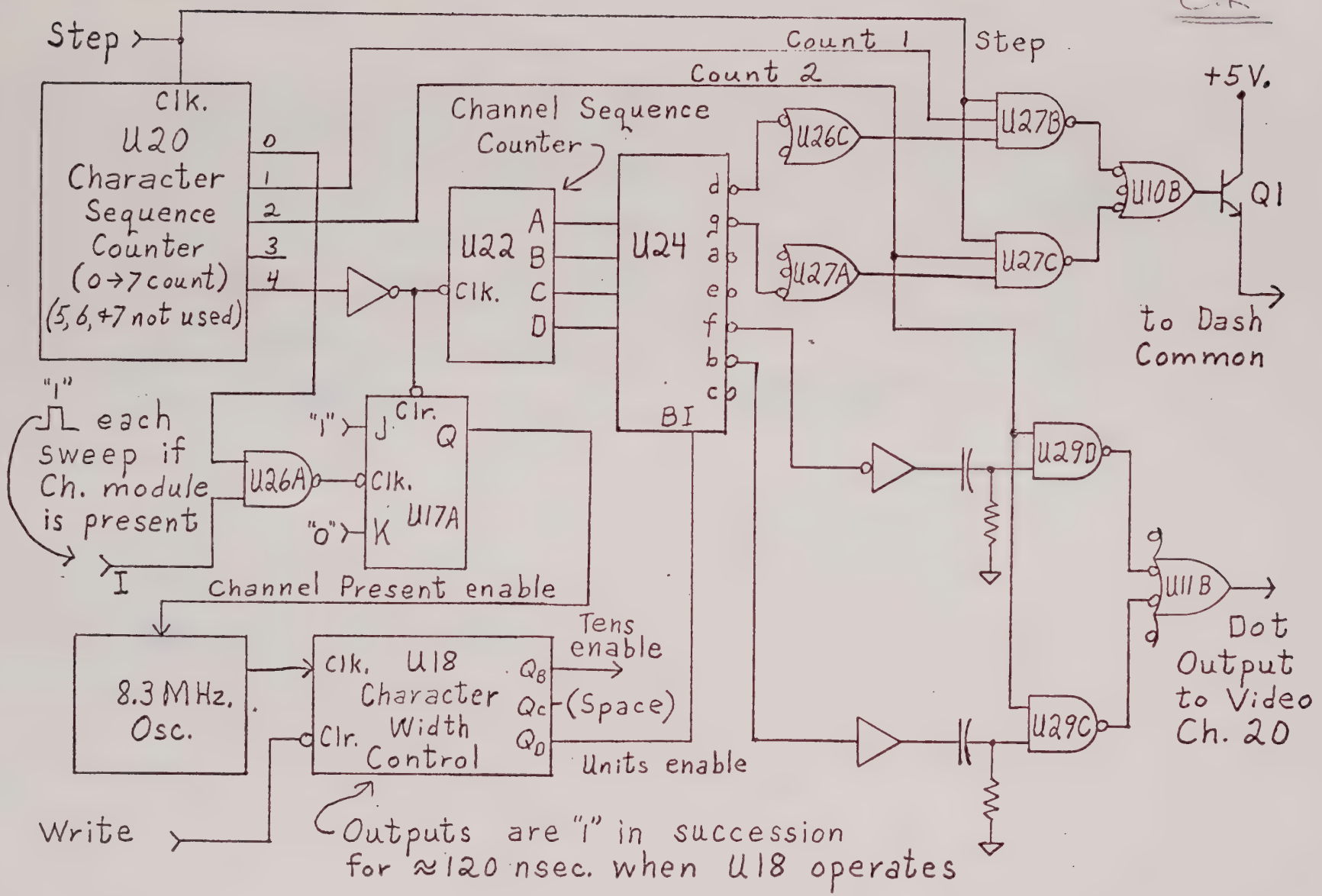
O.K.



1858 Trace I. D.

Block Diagram

C.K

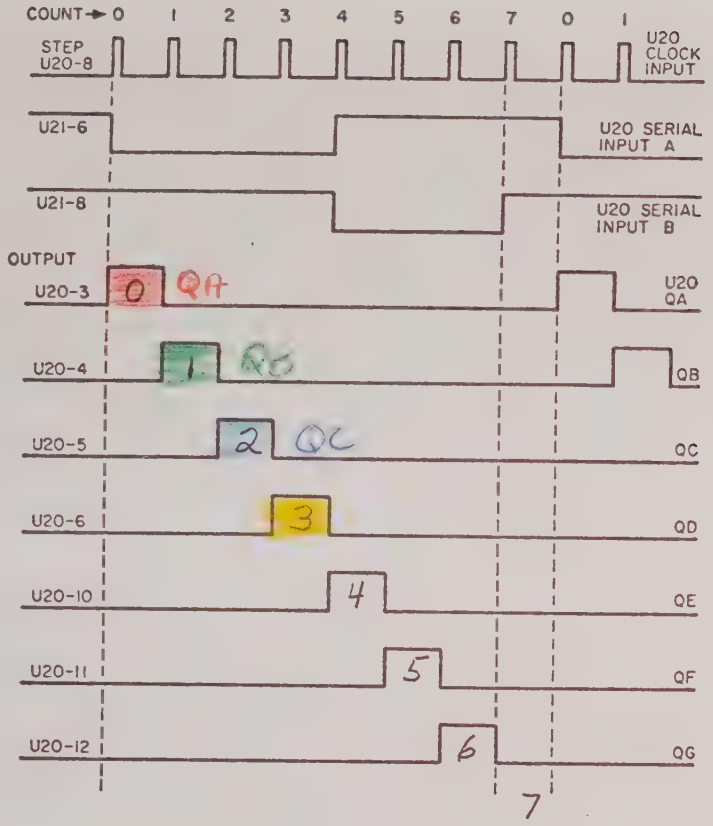


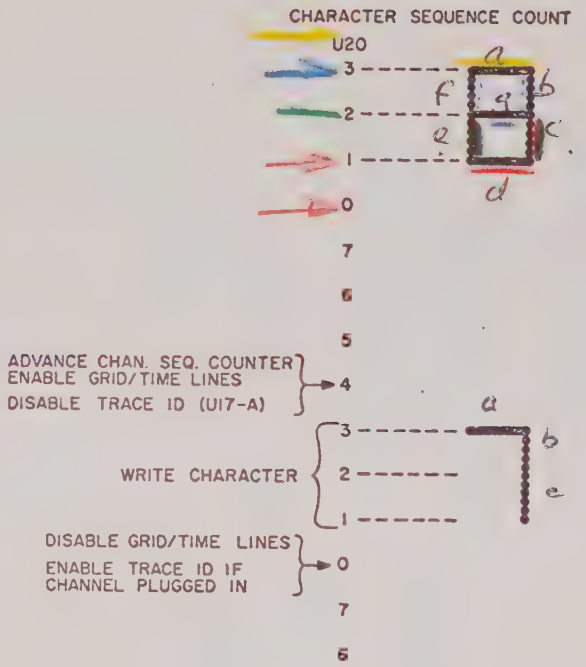
1858 Trace I.D.

Character Sequence Counter, Channel Counter, and 7-bar Printer

Colors are wrong !!

OK

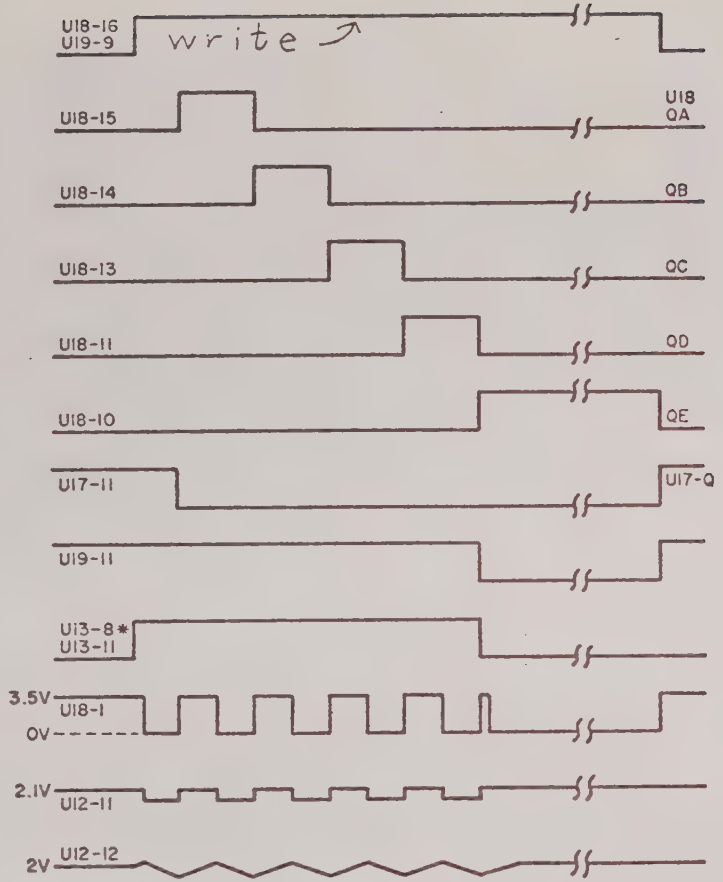


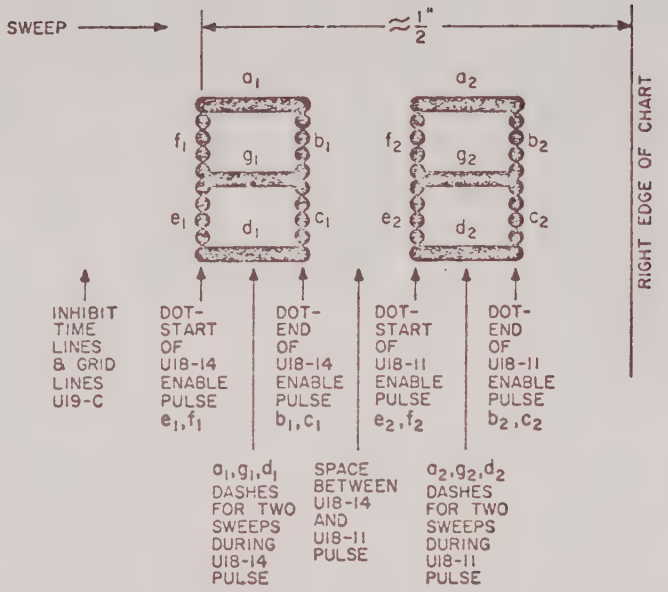


1858 Trace I.D.

Character Sequencing

O.K.

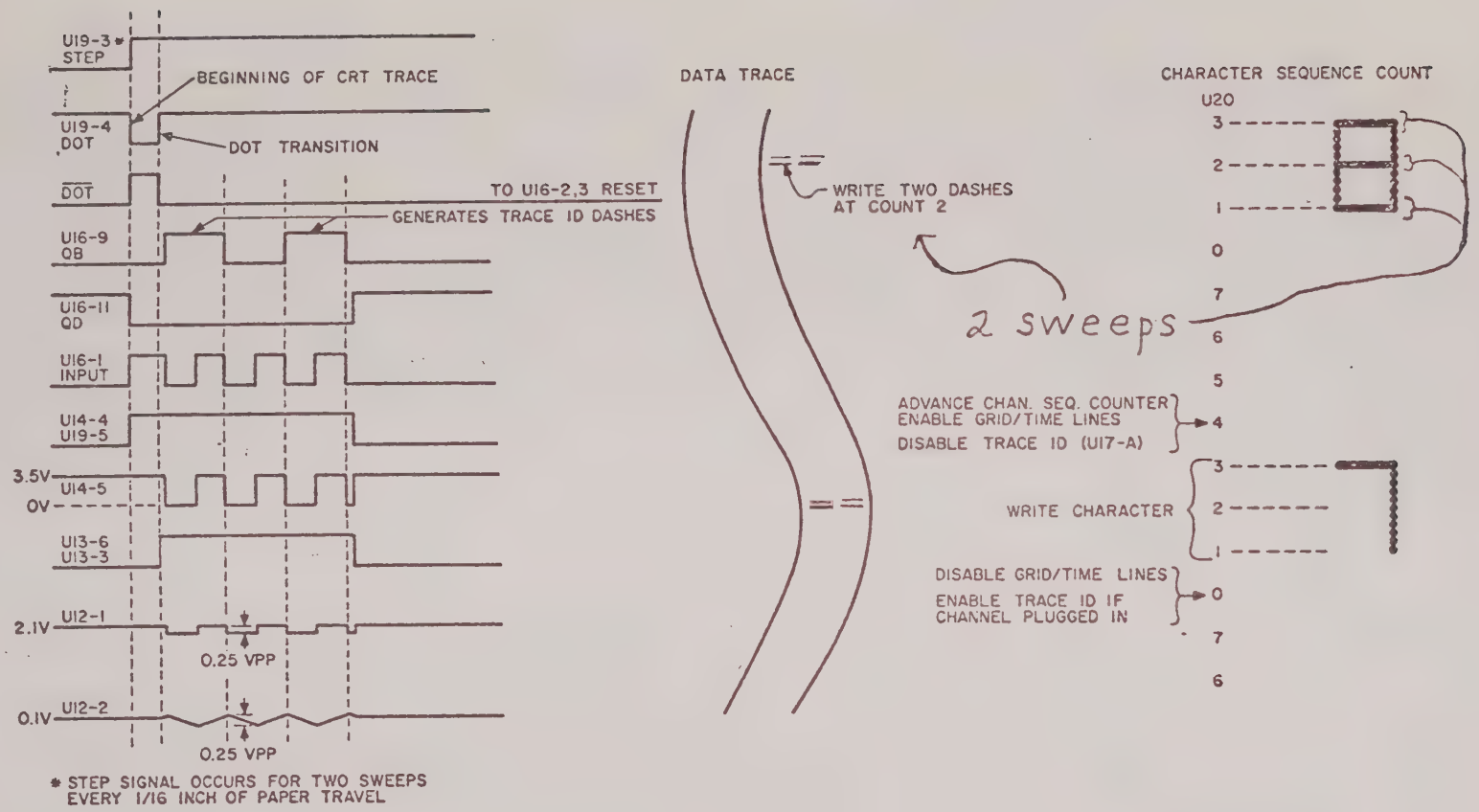



SWEEP
≈1/2"
RIGHT EDGE OF CHART
INHIBIT TIME LINES & GRID LINES U19-C
DOT-START OF U18-14 ENABLE PULSE e1,f1
DOT-END OF U18-14 ENABLE PULSE b1,c1
DOT-START OF U18-11 ENABLE PULSE e2,f2
DOT-END OF U18-11 ENABLE PULSE b2,c2
a1,g1,d1 DASHES FOR TWO SWEEPS DURING U18-14 PULSE
SPACE BETWEEN U18-14 AND U18-11 PULSE
a2,g2,d2 DASHES FOR TWO SWEEPS DURING U18-11 PULSE

1858 Trace I.D.

Character Formation

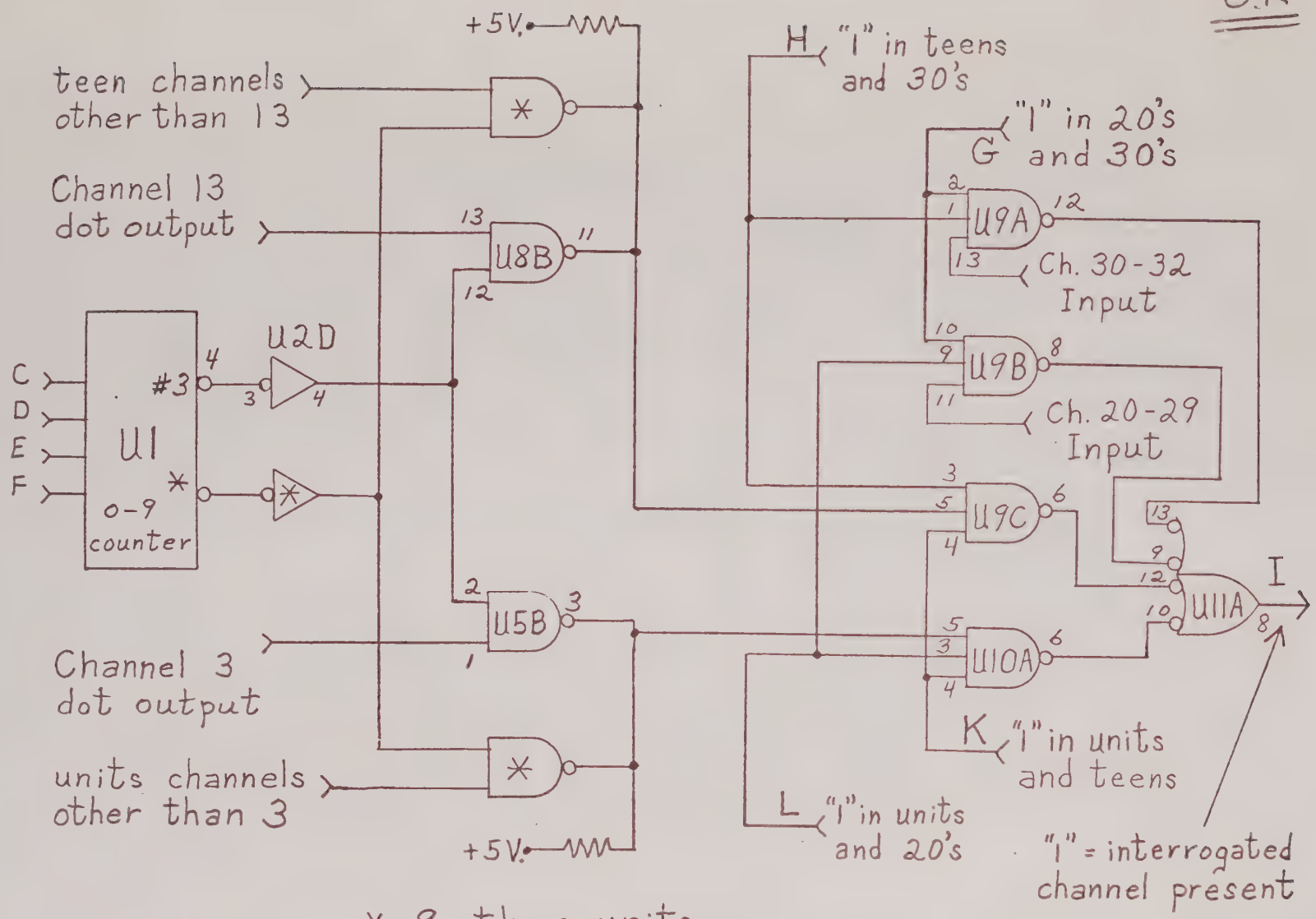
OK



1858 Trace I.D.

Trace I.D. Dashes

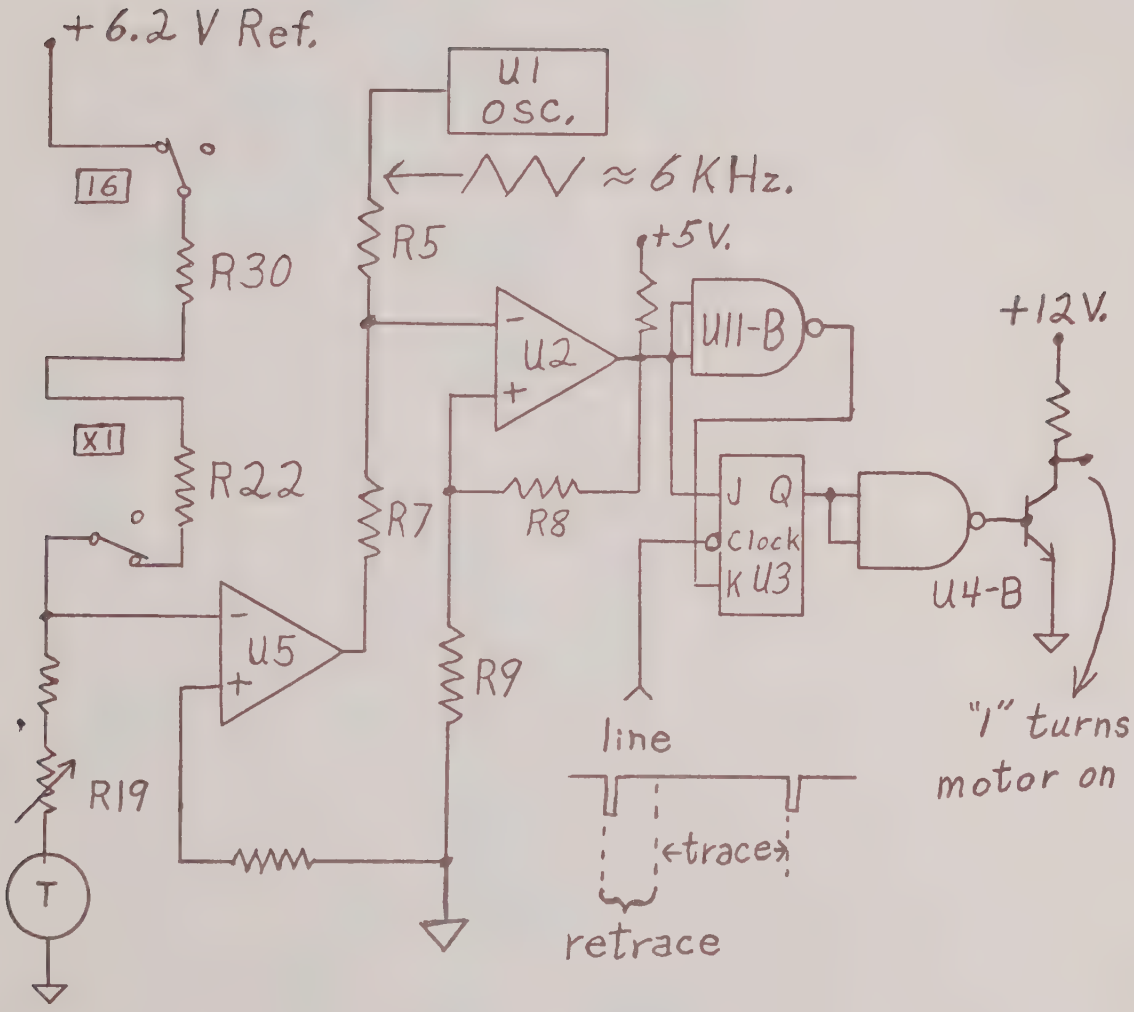
O.K.



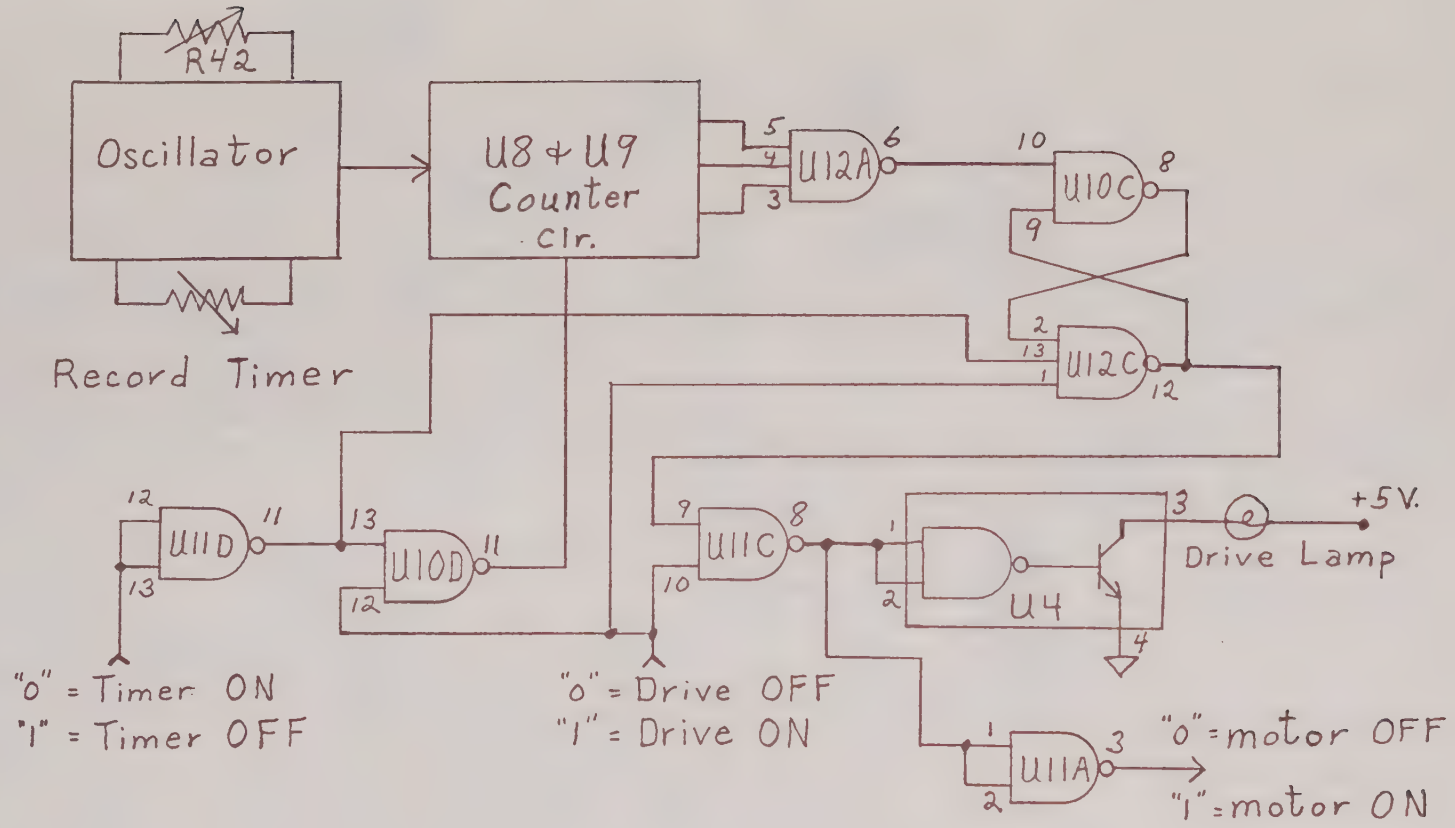
* 9 other units

1858 Trace I.D.

Channel Interrogator

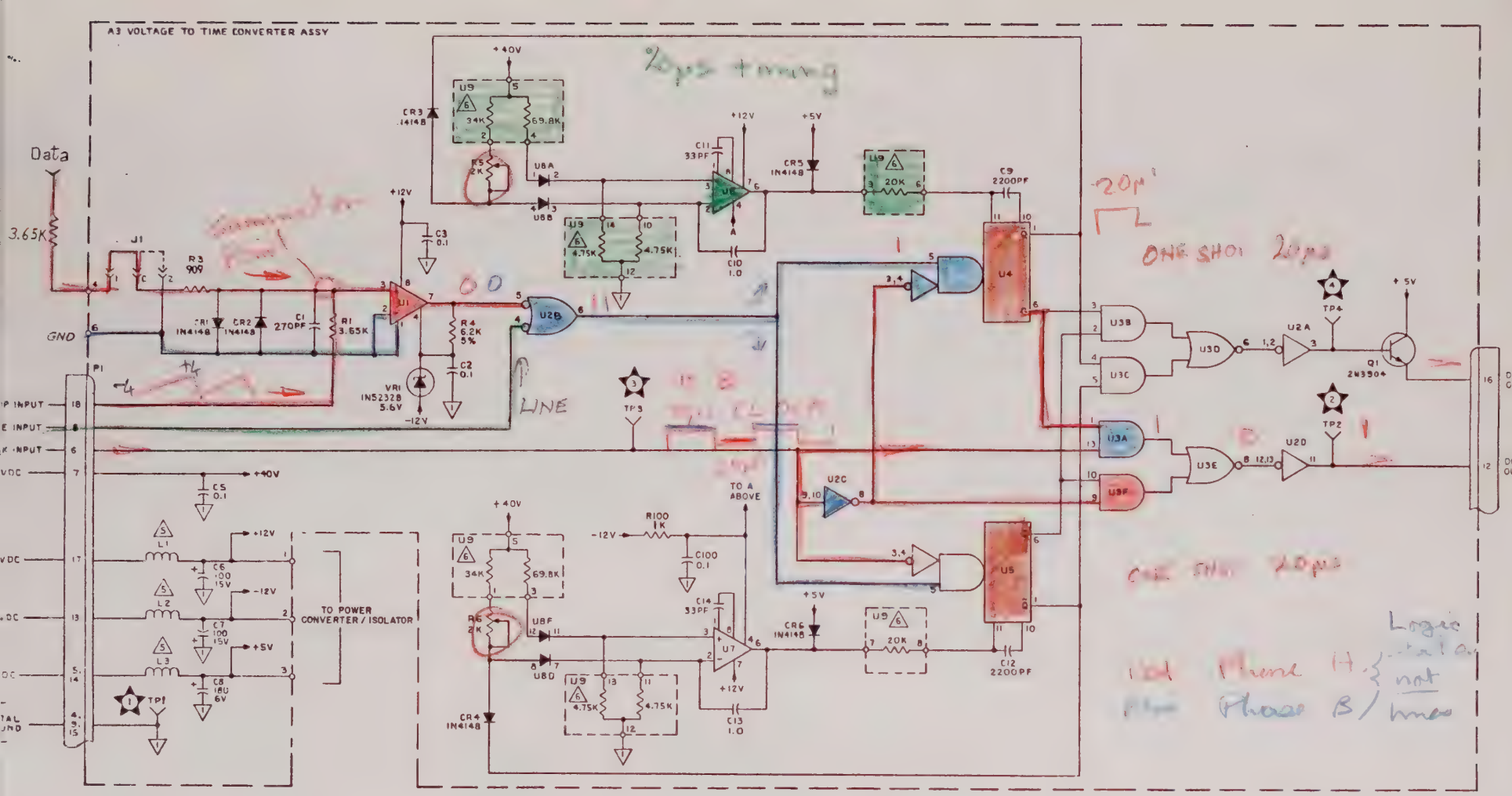

+6.2 V Ref.
U1
osc.
≈6 KHz.
16
R30
R5
+5V.
U2
U11-B
+12V.
X1
R22
R7
R8
J Q
Clock
K U3
U4-B
U5
R9
line
"1" turns
motor on
R19
T
trace
retrace

1858 Servo



1858 Servo

Record Timer

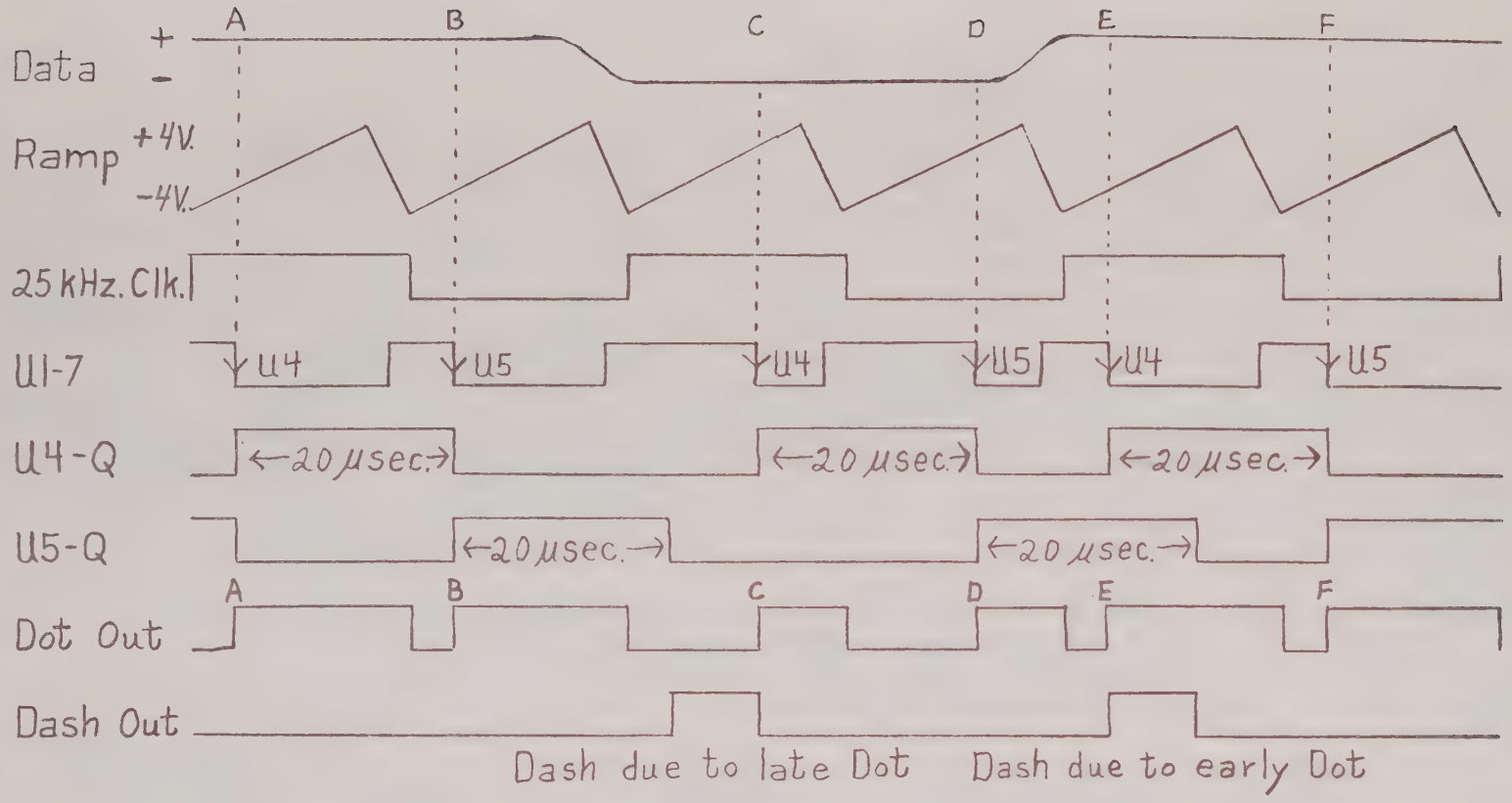


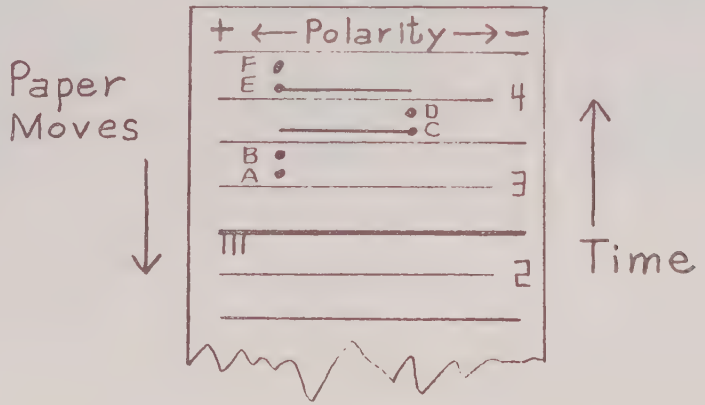
REF 1677

Figure 7-3. Voltage-To-Time Converter Schematic Diagram (Sheet 2

1882
12/72

7-



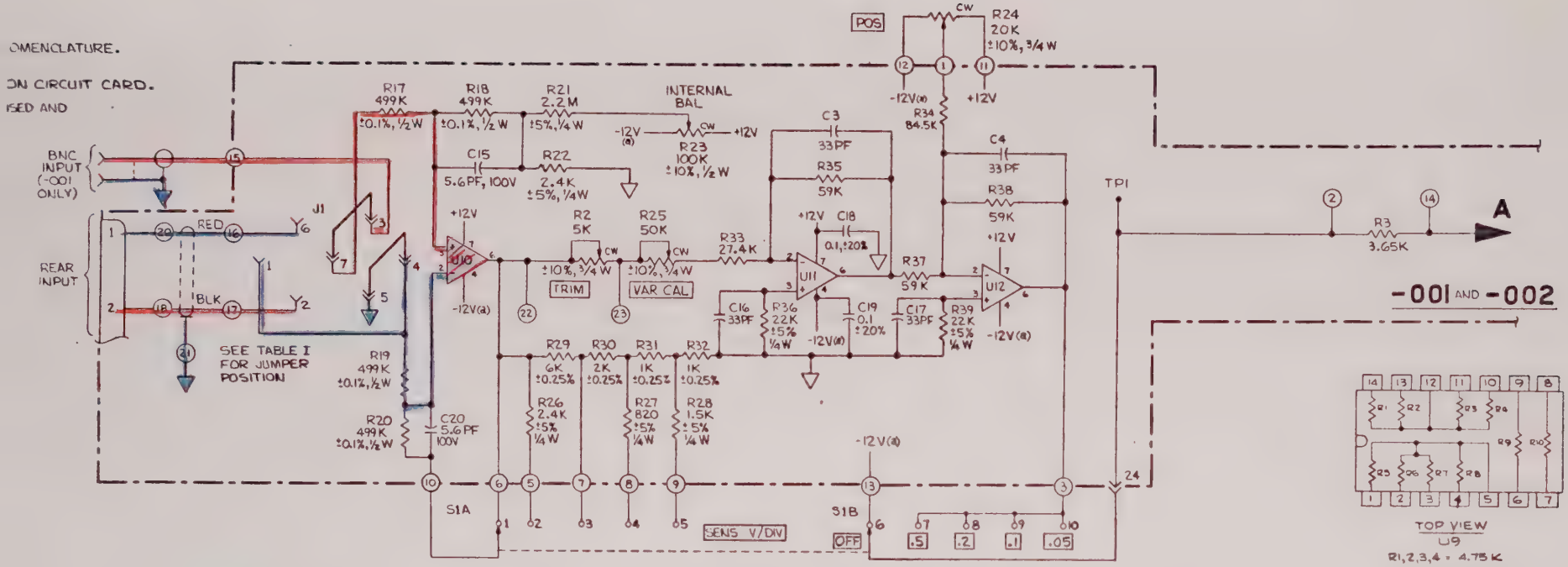


1858 Voltage to Time Conversion

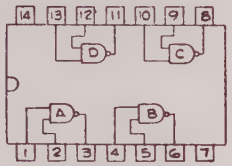
OMENCLATURE.

ON CIRCUIT CARD.

ISED AND

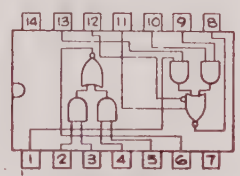


TOP VIEW
U9
R1,2,3,4 = 4.75K
R5,6 = 34K
R7,8 = 69.8K
R9,10 = 20K

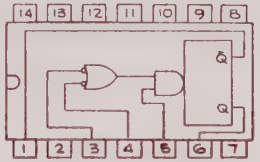


TOP VIEW
SN7400N - U2
PIN 14 = +5V
PIN 7 = GND

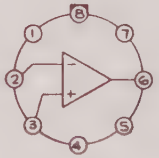
TOP VIEW
UA710C - U1



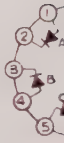
TOP VIEW
SN7451N - U3



TOP VIEW
SN7412IN - U4,5



TOP VIEW
LM301A - U6,7
N5556T - U10,11,12 (-001,-002 ONLY)



TOP
CA3039

2 of 3)

1883
1/73

MODULE.

i. To reinstall the transport module, reverse the procedure..

E. CALIBRATION

Calibration or verification of the power supply voltages should be performed before calibration of any other circuits in the Model 1858. Recalibration is recommended whenever components in the adjustable circuits have been replaced and as part of a monthly maintenance routine to assure optimum performance. Read the entire calibration procedure before attempting calibration.

1. Power Supplies

Because of the extreme sensitivity of the display circuits, recalibration of the power supplies may necessitate recalibration of the entire system.

a. -12 Vdc Regulator (Circuit Card A3A7)

(1) Remove the top and bottom covers and open the rear panel.

(2) Remove the ±12 Vdc power supply regulator circuit card A3A7.

(3) Install the extender card in the A3A7 card slot and mount the ±12 Vdc power supply card in the extender card. Slide back the insulation on the extender card wire loops to allow for test equipment connections.

(4) Back all A3 circuit cards except the +40 Vdc and +5 Vdc power supply card A3A6 out of the connector.

(5) Open the paper cradle to disable the paper drive servo.

(6) Slide off the connector at the bottom of the high voltage assembly A3A11.

(7) Slide out all plug-in modules.

(8) Set a 100 watt variable resistive load to 15.8 ohms. If this item is not available, a suitable substitute can be made from standard parts as shown in Figure 5-2 below.

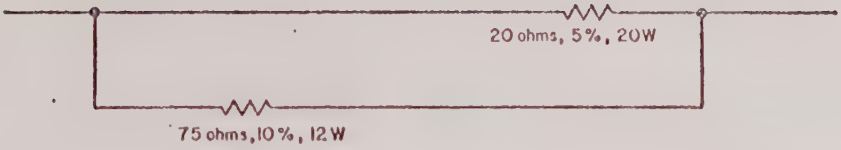


Figure 5-2. Locally Manufactured 15.8 Ohm Load.

(9) Connect the resistive load between pin 13 on the extender card and the instrument chassis. (Pin 1 is at the top of the extender card.)

(10) Connect the voltmeter at the loop on pin 13 (-) and chassis ground.

(11) Adjust current limit control R23 (A3A7) to its maximum CCW position.

(12) Engage the POWER pushbutton.

(13) Adjust R22 (A3A7) for a reading on the voltmeter of -12 Vdc ±0.1V.

(14) Turn R23 (A3A7) clockwise until the voltmeter reading drops 50 to 200 millivolts. This sets the current limit to 725-800 mA.

(15) Release the POWER pushbutton.

b. +12 Vdc Regulator (Circuit Card A3A7).

(1) Move the test equipment from the loop on pin 13 to the loop on pin 10. Remember to change the polarity of the voltmeter.

(2) Adjust current limit control R21 (A3A7) to its maximum CCW position.

(3) Engage the POWER pushbutton.

(4) Adjust R20 (A3A7) for +12 Vdc ±0.1V.

(5) Turn R21 (A3A7) clockwise, until voltmeter reading drops 50 to 200 mV. This sets the current limit to 725-800 mA.

(6) Release the POWER pushbutton. Disconnect the test equipment and return the ±12 Vdc regulator card to the A3A7 card slot.

c. +40 Vdc and +5 Vdc Power Supply Circuit Card A3A6.

(1) Remove the +40 Vdc and +5 Vdc power supply circuit card.

(2) Install the extender card in the A3A6 card slot and mount the +40 Vdc and +5 Vdc power supply card in the extender card.

NOTE

With exception of the ±12 Vdc regulator circuit card, which was reinstalled in step 5-4.E.1.b.(6), the setup of the instrument remains as established in steps 5-4.E.1.a.(4) through (7).

(3) Adjust the variable 100 watt load to 40 ohms. The 40 ohm load may be made from standard parts as shown in Figure 5-3.

Figure 5-3. Locally Manufactured 40 Ohm Load.

Connect the 40 ohm load from pin 4 on the extender card to the instrument chassis.

(4) Connect the voltmeter between the pin 4 loop (+) and the instrument chassis.

(5) Adjust current limit control R10 (A3A6) to maximum CCW position.

(6) Engage the POWER pushbutton.

(7) Adjust R8 (A3A6) for a voltmeter reading of 40 Vdc ±0.2V.

(8) Turn R10 (A3A6) clockwise until the voltmeter reading drops 50 - 200 mV. This sets the current limit to .95 - 1.05 amperes.

(9) Release the POWER pushbutton. Remove the voltmeter and resistive load.

(10) Connect the + terminal fo the voltmeter to A3A6, pin 15, and the - terminal to the chassis.

(11) Adjust a 100 watt variable load to 2/3 ohm or make up the load shown in Figure 5-4.

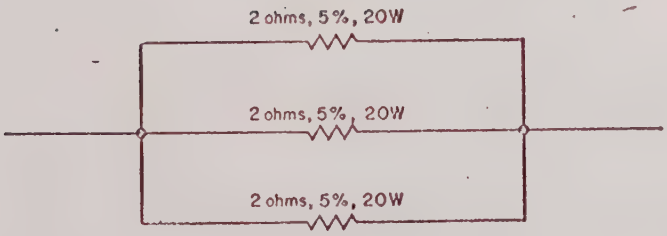


Figure 5-4. Locally Manufactured 2/3 Ohm Load

Connect load and ammeter from A3A6, pin 15 to the chassis. Set ammeter to 10 ampere scale.

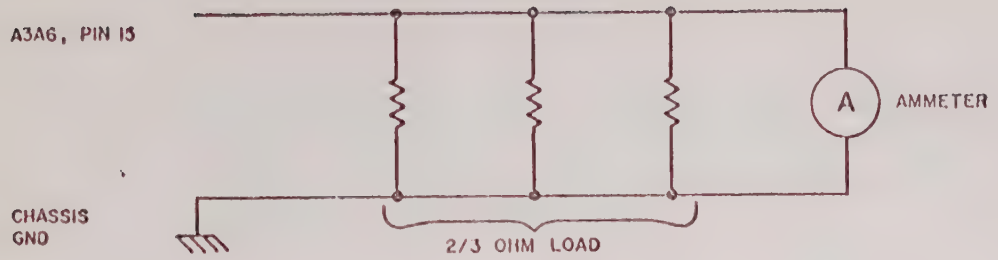


Figure 5-5. Short Circuit Current Measurement Set Up

The ammeter connected in Figure 5-5 shorts out the 5 volt supply so the short circuit current may be measured.

(12) Adjust current limit control R18 (A3A6) to its maximum CW position. Adjust R20 (A3A6) to its maximum CCW position.

(13) Engage the POWER pushbutton.

(14) Adjust short circuit current control R20 (A3A6) for a 1 - 1.2 amp reading.

(15) Remove the ammeter. Adjust R14 (A3A6) for 5.0 Vdc ±.05V.

(16) Adjust R18 (A3A6) CCW until the voltmeter reading drops 25 to 100 millivolts. This sets the current limit to 7.1 - 7.9 amps.

(17) Release the POWER pushbutton. Remove resistive load and test equipment. Reinstall the regulator circuit card in the A3A6 slot.

(18) Slide all A3 circuit cards firmly into their connector. Close the paper cradle.

(19) Reinstall connector on the bottom of the high voltage card A3A11.

NOTE

Do not slide in the plug-in modules.

2. Display System Calibrations

The following series of calibrations form a single calibration of the display system and are separately identified only for clarity. With the exception of steps a.(3)through a.(5), the entire procedure must be performed in sequence from beginning to end to achieve calibration of the display system.

NOTE

The final focus adjustment is located in gridline calibration section paragraph 5-4.E.2.f. because of availability of a known signal.

a. PAPER Supply Indicator

(1) Remove the clock circuit card A3A3, install it on the 30/60 pin extender card and reinstall the assembly in the A3A3 card slot.

(2) Engage the POWER pushbutton.

(3) Open the cradle and remove paper.

(4) If the PAPER supply indicator does not read E, loosen the set serew on the paper sensor arm and position the sensor resistor resistor (small screw at the pivot of the sensor arm) to achieve an E reading on the indicator. Retighten the set screw.

NOTE

Do not try to make this adjustment by removing the sensing arm - it is spring loaded and difficult to reinstall.

(5) Fully depress the paper sensor arm and adjust A3A3R25 for an F reading on the indicator. Release the sensor arm. The indicator reading should return to E.

This adjustment will be approximately correct for the largest roll of paper used in the machine. If desired, the calibration can be made with a full roll of paper installed of the type planned for use with the machine.

b. Clock Oscillator

(1) Connect a frequency counter to J3 (A3A3). Set the counter start slope to + and the stop slope to +.
Adjust the counter controls to determine the period of the square wave.

(2) Adjust R51 (A3A3) to achieve a counter reading of 20 μsec ±0.2 μsec. Remove the counter.

(3) Release the POWER pushbutton.

WARNING

The following series of steps requires working in close proximity to the high voltage card and its lethal voltages. Observe the electrical precautions described in paragraph 5-2.

CAUTION

The high voltage card must be securely bolted to the chassis whenever turning power on with the high voltage card installed.

c. Ramp Signal

(1) Place jumper A3A1J1 (video card) in the C to 2 position. Connect the red and violet leads from the high voltage card to pins B and E respectively on the A3A1 video card.

(2) Connect the oscilloscope probe to A3A3J2 (clock card). Use internal triggering.

(3) Connect a clip lead from A3A11 pin 3 (third pin from right at the rear of the high voltage power supply connector) and from A3A11, pin 6 sixth pin from right) to chassis ground.

(4) Engage the POWER pushbutton.

(5) Adjust A3A11R10 (intensity, on top left of the high voltage power supply) for a visible trace.

NOTE

Make sure the DRIVE pushbutton remains released.

(6) Hold a piece of recording paper against the CRT, and adjust A3A11R1 (through the opening on bottom of the high voltage power supply) for a trace length of eight inches (width of recording paper). If one end of trace is off edge of CRT, adjust the magnets on CRT neck to bring edge on CRT for adjustment of eight inches. Do not be concerned about vertical or horizontal centering at this point.

(7) If required, rotate yoke for a horizontal display.

(8) Adjust intensity (A3A11R10 on top left of the high voltage power supply) maximum CCW for no display.

(9) Adjust A3A3R1 (on clock card) for 7.2 ±.05 V p-p ramp amplitude on oscilloscope.

This makes swept length in fact 9.66 in

(10) Adjust A3A11R1 (through opening on bottom of the unit) for 8.4 ±0.1V p-p ramp amplitude on oscilloscope.

(11) Adjust A3A3R82 (clock card) so that the ramp is centered around O V.

(12) Engage DRIVE pushbutton and adjust A3A11R10 for a barely visible trace. Hold a scale against CRT. Adjust A3A3R1 for 7.85 ±0.05 inches of trace on CRT.

(13) Run paper at 1 IN/SEC. Adjust magnet so that right edge of trace is printed on right edge of paper within 0.05 inch or less, and trace is centered vertically on CRT face.

(14) Verify that ramp signal is centered around O V and exceeds 4.2 V in each direction above and below O V.

(15) Release DRIVE and POWER pushbuttons.

d. Vertical Oscillator

(1) Install the wire link jumper J1 (A3A3) in the C to 2 position.

(2) Remove the wire jumper from A3A11, pin 6 to ground on the high voltage card.

(3) Engage the POWER and DRIVE pushbuttons.

(4) Adjust R46 (A3A3) to center the raster vertically on the CRT aperature.

(5) Adjust R45 (A3A3) for a vertical raster height of 0.2 to 0.22 inches.

(6) Release the DRIVE and POWER pushbuttons.

(7) Remove the extender card from the A3A3 slot. Move J1 jumper on the clock card (A3A3) to the C to 1 position.

(8) Install clock card in the A3A3 slot.

(9) On the video card, move jumper J1 to the C to 1 position.

(10) Remove the wire jumper from pin 3 to ground on the high voltage card.

e. Gridline Generator A3A4

(1) Remove the gridline generator card. Install

1858

it on an extender card and install the assembly in the A3A4 card slot.

(2) Lock in the POWER pushbutton

(3) Monitor the anode of A3A4VR1 with a voltmeter.

(4) Adjust A3A4R20 for a voltmeter reading of -6.5 Vdc ±0.05V.

Alternate Method ← see gold pages step (6)

(5) Disconnect the voltmeter.

(6) Set the GRIDLINE switch to CONTinuous.

(7) If the timeline option is present, set the TIMELINE control to .01 SEC.

(8) Release all MULTIPLIER and RECORD SPEED pushbuttons.

(9) Open the paper cradle and engage the DRIVE pushbutton.

(10) The display on the CRT should appear as shown in Figure 5-6.

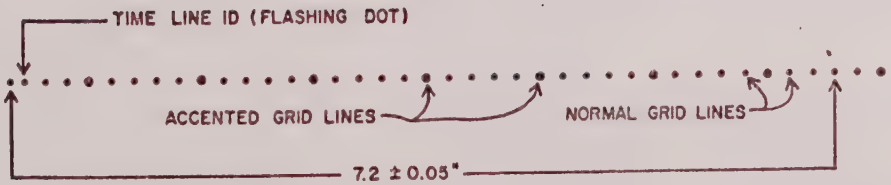


Figure 5-6. Gridline Display.

(11) If the display is not present, adjust R24 (A3A4) CCW until the accented gridlines appear.

(12) If the accented gridline does not appear in step (12) adjust R31 (A3A4) CCW.

(13) Adjust A3A1R74 (video card) for medium intensity of the accented gridlines.

it on an extender card and install the assembly in the A3A4 card slot.

(2) Verify that both jumpers A3A4J1 and J2 are placed in the C to 1 positions.

Alternate Method starts here

(3) Lock in the POWER pushbutton.

(4) Monitor the anode of A3A4VR1 with the Fluke voltmeter.

(5) Adjust A3A4R20 for a voltmeter reading of -6.5 Vdc $\pm$ 0.05V.

(6) Disconnect the voltmeter.

(7) Set the GRIDLINE switch to CONTinuous.

(8) Connect the oscilloscope probe to the junction of A3A4R27 and R28.

(9) Adjust A3A4R24 for a sag of -0.30 $\pm$ 0.05V at the beginning of the signal on the oscilloscope. See Figure 5-2.

(10) Release the POWER pushbutton. Remove the oscilloscope probe at A3A4R27-R28 junction and connect oscilloscope probe to the video amplifier output A3A1 terminal B (the RED wire).

(11) Remove the extender card and install the gridline card in the A3A4 slot.

(12) Lock in the POWER and DRIVE pushbutton.

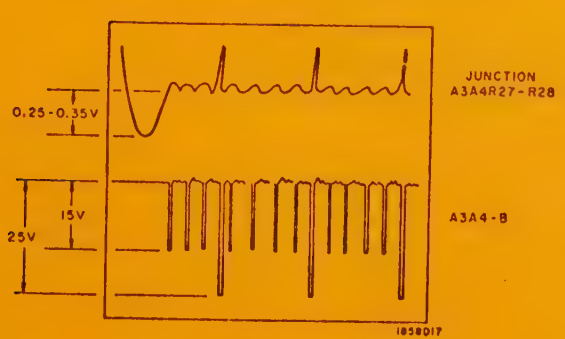


Figure 5-2. Gridline Signals

(13) Adjust A3A4R31 through the bottom of the unit for 38 grid lines

NOTE

Steps 9 and 13 may have considerable interaction. Repeat as necessary to meet both requirements.

(14) Adjust A3A1R74 for an accented pulse amplitude of about 25V.

If a high frequency oscilloscope is not available, the apparent measurement of signal amplitude will only be approximately 80 to 90% of actual amplitude. Perform the adjustment to achieve a recorded accented gridline width not greater than 0.015 inch.

(15) Adjust A3A1C54 for a normal gridline pulse amplitude about 15V.

If a high frequency oscilloscope is not available, the apparent measurement of signal amplitude will be only 50 to 66% of actual amplitude. Perform the adjustment to achieve a recorded normal gridline width not greater than 0.010 inch.

Return to white page 5-24, step (16)

(14) Adjust A3A1C54 (video card) for medium intensity of the normal gridlines.

Return from Alternate Method

(15) Adjust R31 (A3A4) for 38 gridlines.

(16) Adjust R24 (A3A4) to position the first gridline coincidental with the flashing timeline identification dot at left side of the CRT.

If the timeline option is not present, this adjustment should place the first gridline 0.5 ± 0.12 inch from the left edge of the normal path of the recording paper.

NOTE

Steps (15) and (16) interact and may need to be repeated until the desired setup is achieved.

(17) Engage the 1 IN/SEC and x 1.0 pushbuttons. If the timeline option is present, set the TIMELINE switch for 1 SEC.

(18) Adjust R31 (A3A4) so that the spacing between 37 gridlines is 7.2 ± 0.05 inches. Make the initial adjustment with a ruler on the CRT, then run a record to make final adjustment. Each fifth line should be accented (wider) than the normal gridlines.

(19) Adjust R24 (A3A4) so that the left gridline coincides with the timeline identification marker, if present, or in position 0.5 inch from the left edge of the paper.

(20) After final adjustment, there may be 37, 38, or 39 gridlines present.

(21) Release the POWER pushbutton.

(22) Remove the extender card and reinstall the gridline generator card in the A3A4 card slot.

f. Video Adjustments

There are three adjustments on the video card which affect the line thickness and intensity on the record.

R64 sets the amplitude of the dashes which form the timelines.

R74 sets the amplitude of the dot signals which form the gridlines, data traces, timeline I.D.'s and the dot components of the trace numbers. C54 sets the intensity of the normal gridlines.

(1) Release the DRIVE pushbutton.

(2) Increase the intensity of the CRT presentation by adjusting R10 on the top left side of the high voltage card until visible. Then adjust R10 until the trace just disappears.

(3) Engage the DRIVE pushbutton, run a record and make the following adjustments on the video card.

(4) Adjust A3A11R17 for best gridline focus (right hand adjustment on top of high voltage power supply cover).

(5) Set A3A1R64 on the video card for the thinnest looking timelines on the paper. Make the adjustment from the rear of the instrument.

(6) Adjust A3A1R74 (at rear of video card) for crisp looking data signals and so that the vertical and horizontal strokes of trace numbers are about equal in intensity. The fifth accented gridlines will be almost the same thickness as the tenth accented time timelines.

(7) Adjust A3A1C54 (at rear of video card) so that the normal gridlines are about the same thickness as the timelines.

(8) If intensity of the pattern cannot be reduced sufficiently with A3A1R64 and/or A3A1R74 set at minimum, adjust A3A11R10 CCW (left hand adjustment on top of high voltage power supply cover).

3. Paper Drive Calibration

a. Engage the POWER pushbutton. Depress RECORD SPEED buttons 8 and 2. Depress X.1 MULTIPLIER button, If the timeline

option is present, set the TIMELINE control to 1 SEC. If the timeline option is not present, connect a 0.5 Hz squarewave from the function generator through one of the plug-in modules. Close cradle.

b. Engage the DRIVE pushbutton and run about 2 feet of paper. Adjust R19 on the servo card to attain a spacing of 10 ±0.2 inches between any two accented time lines. Turning R19 CCW increases the spacing between the time lines.

c. Depress the 1 IN/SEC pushbutton. Depress MULTIPLIER button x.1. Set TIMELINE switch to 10 SEConds. Engage the DRIVE pushbutton. Run about 2 feet of paper. Check for spacing of 10 ±0.2 inches between any two accented time lines. If necessary, adjust R17 on the servo card. If adjustment is necessary, repeat step 3.b, then 3.c as necessary to be within specification.

d. On the servo circuit card A1A1, connect a frequency counter to the R45 lead closest to Q2.

e. Set the RECORD TIMER to 60 and adjust A1A1R42 for a period reading on the counter of 268 milliseconds.

f. Set the RECORD TIMER to OFF and adjust A1A1R55 for a period reading of 1.68 milliseconds.

g. Repeat steps e and f until interaction is minimized and the correct readings are achieved.

h. Remove the frequency counter.

i. Open the paper cradle.

j. Set the RECORD TIMER to 60. Engage the DRIVE pushbutton and check with a watch to verify that the servo drives for 60 ±3 seconds.

k. If necessary, adjust A1A1R42 to achieve the correct time.

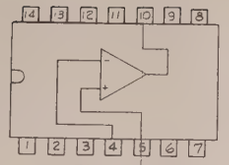
l. Release the DRIVE and POWER pushbuttons.

SECTION 7

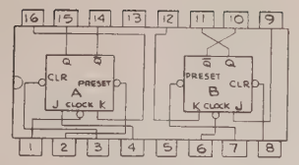
SCHEMATICS

NOTES:

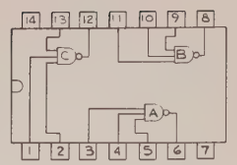
1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, ±1%, ¼ W.
   CAPACITANCE VALUES ARE IN U F, ±10%, 50V.
   DIODES ARE IN4148.
2. REFERENCE DESIGNATIONS ARE SHOWN FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.
3. ONLY PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH A3.
4. INDICATED DESIGNATIONS ARE COMPLETE.
5. ▭ DENOTES PANEL NOMENCLATURE



TOP VIEW
L709-1 -U1
PIN 11 = +12V
PIN 6 = +12V

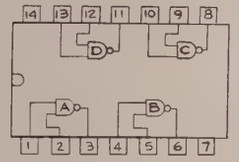


TOP VIEW
SN7476N
PIN 5 = + 5V
PIN 13 = GND

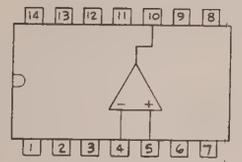


TOP VIEW
SN7410N-U12
PIN 14 = +5V
PIN 7 = GND

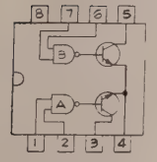
TOP VIEW
N5556T-U5
PIN 7 = +12V



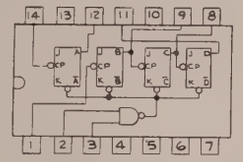
TOP VIEW
SN7400N
PIN 14 = +5V
PIN 7 = GND



TOP VIEW
L741-1 - U6, 7
PIN 11 = +12V
PIN 6 = -12V

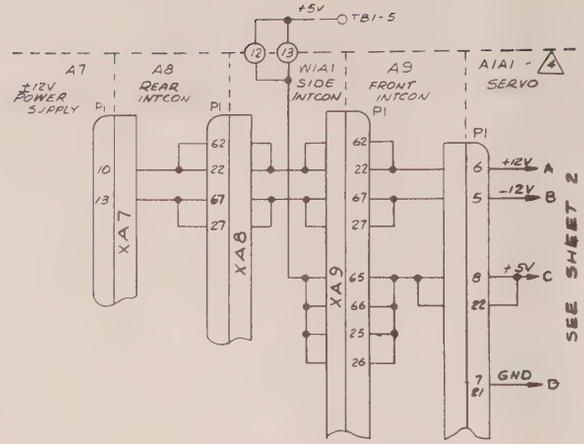


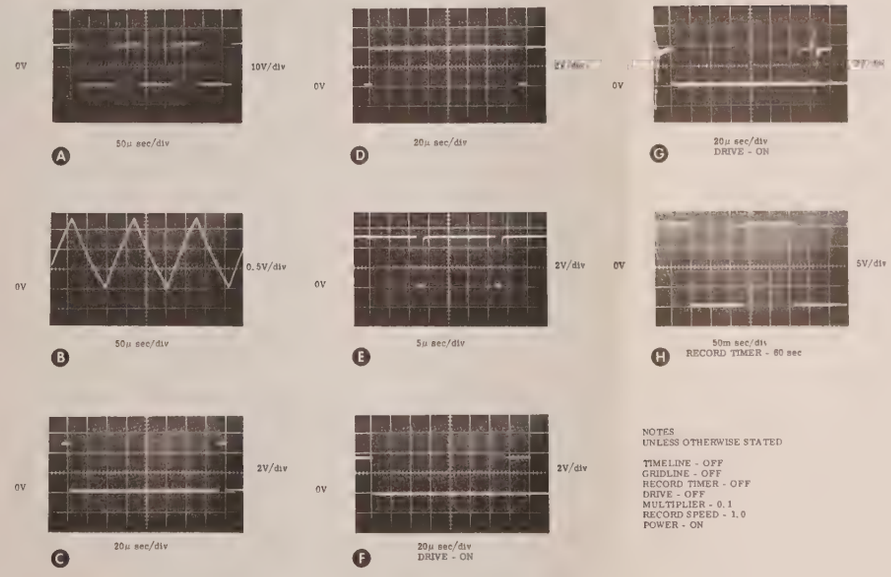
TOP VIEW
SN75451P-U4
PIN 8 = +5V
PIN 4 = GND



TOP VIEW
SN7493N
PIN 5 = +5V
PIN 10 = GND

TOP VIEW
LM-311H-U2
PIN 8 = +12V
PIN 4 = -12V

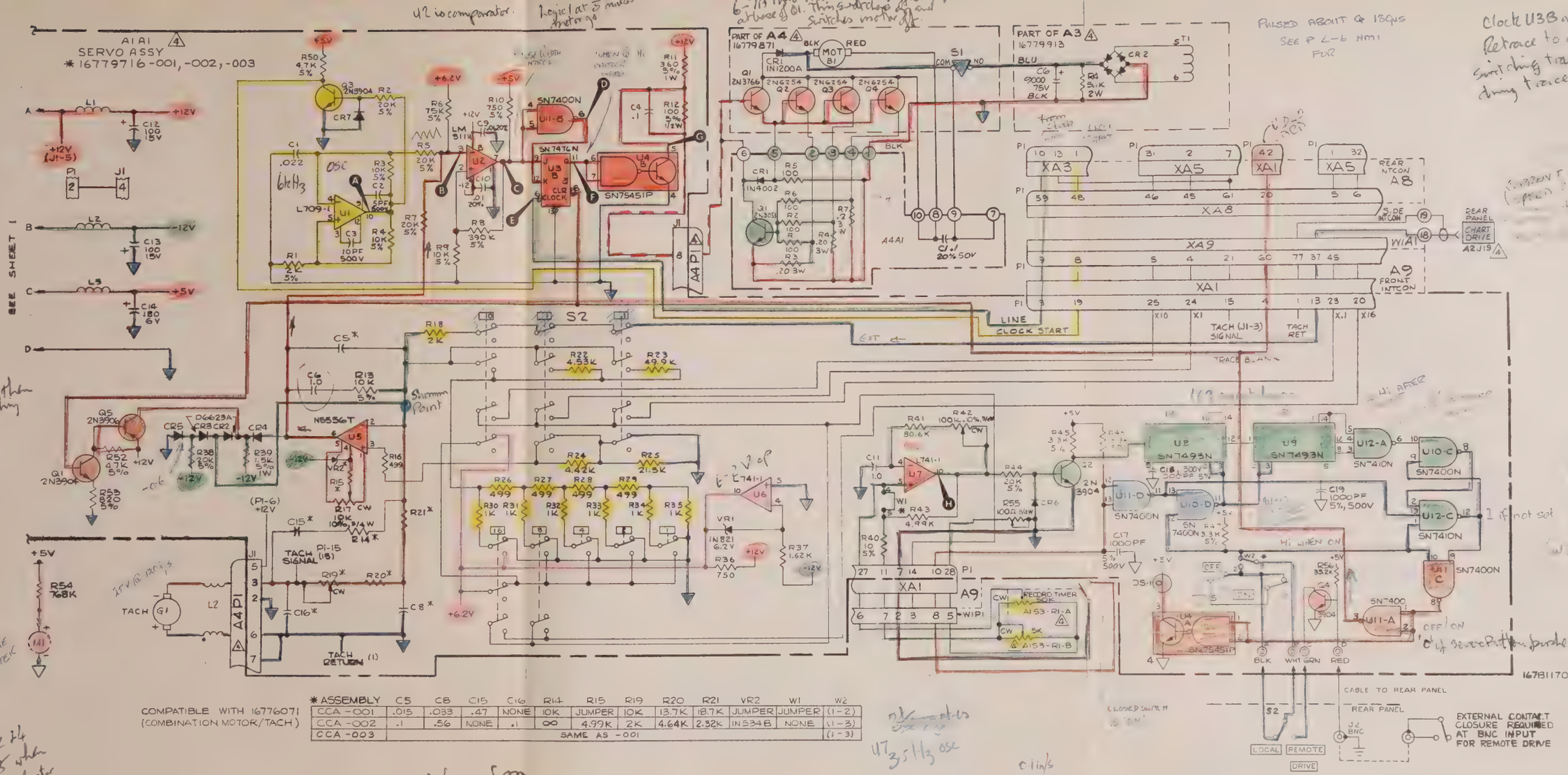




NOTES
UNLESS OTHERWISE STATED

TIMELINE - OFF
GRIDLINE - OFF
RECORD TIMER - OFF
DRIVE - OFF
MULTIPLIER - 0.1
RECORD SPEED - 1.0
POWER - ON

Figure 7-1. Servo Schematic
(Sheet 1 of 2)



* ASSEMBLY	C5	C8	C15	C16	R14	R15	R19	R20	R21	VR2	W1	W2
CCA -001	.015	.033	.47	NONE	10K	JUMPER	10K	13.7K	18.7K	JUMPER	JUMPER	(1-2)
CCA -002	.1	.56	NONE	.1	∞	4.99K	2K	4.64K	2.32K	IN534B	NONE	(1-3)
CCA -003	SAME AS -001											(1-3)

COMPATIBLE WITH 16776071 (COMBINATION MOTOR/TACH)

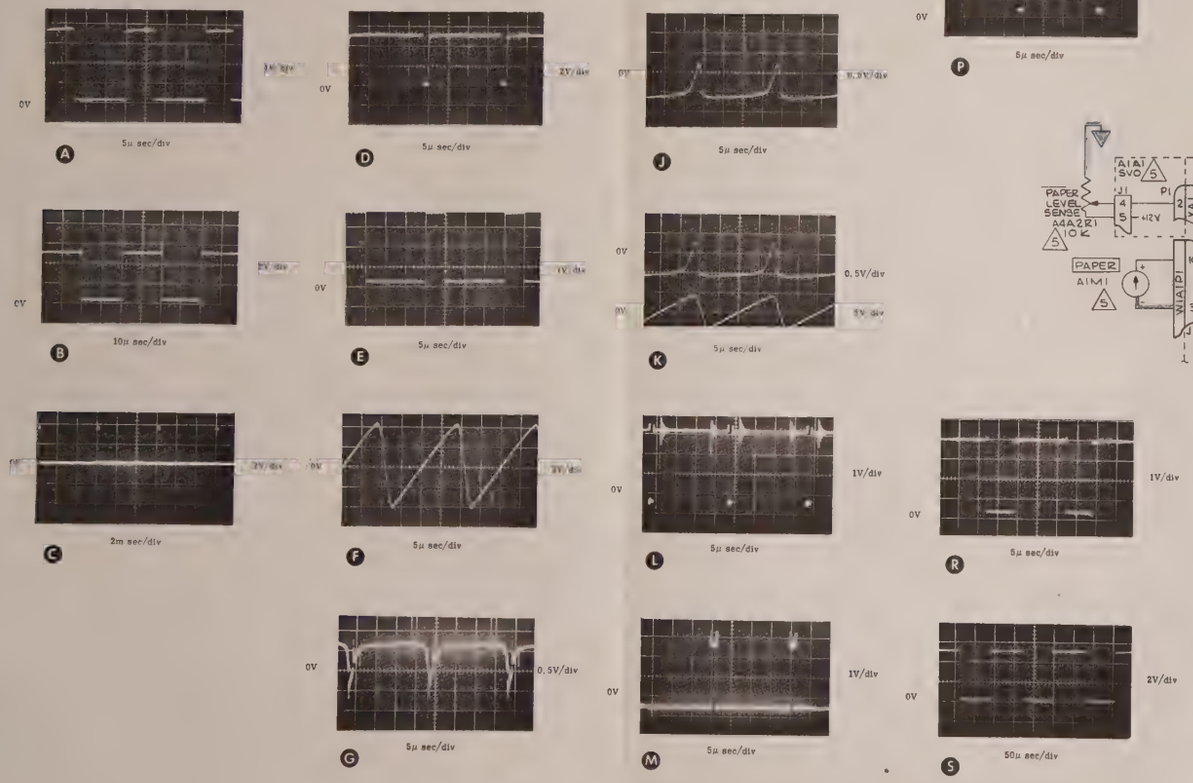
REF 16781170 (B)
Figure 7-1. Servo Schematic (Sheet 2 of 2)

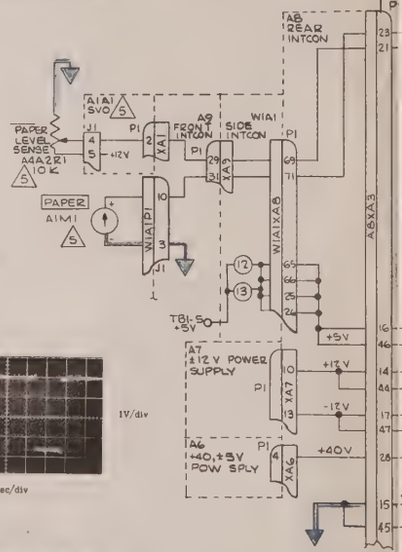
NOTES:

1. UNLESS OTHERWISE SPECIFIED
   RESISTANCE VALUES ARE IN OHMS; ±5%, 1/4W.
   CAPACITANCE VALUES ARE IN UF, ±5%, 50V.
   TRANSISTORS ARE 2N3904.
   DIODES ARE IN4148.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH A3.
3. INTEGRATED CIRCUIT TYPES ARE AS FOLLOWS:

REF DES	U1, U9	U2, U3, U4, 5 U8, U18, U19	U6, U7	U10, U12	U13	U14	U15, 16 / UA710 / U17
TYPE	LM301A	L741-1	SN74121	SN7476	SN7400	SN7410	UA9601

4. CIRCUIT CARD PIN NO. 4-9, 18, 19, 24, 25, 27, 29, 30, 34-39, 48, 49, 54, 55, 59, 60 ARE CONNECTED TO GROUND BUT ARE NOT SHOWN ON DIAGRAM.
5. INDICATED REFERENCE DESIGNATIONS ARE COMPLETE.





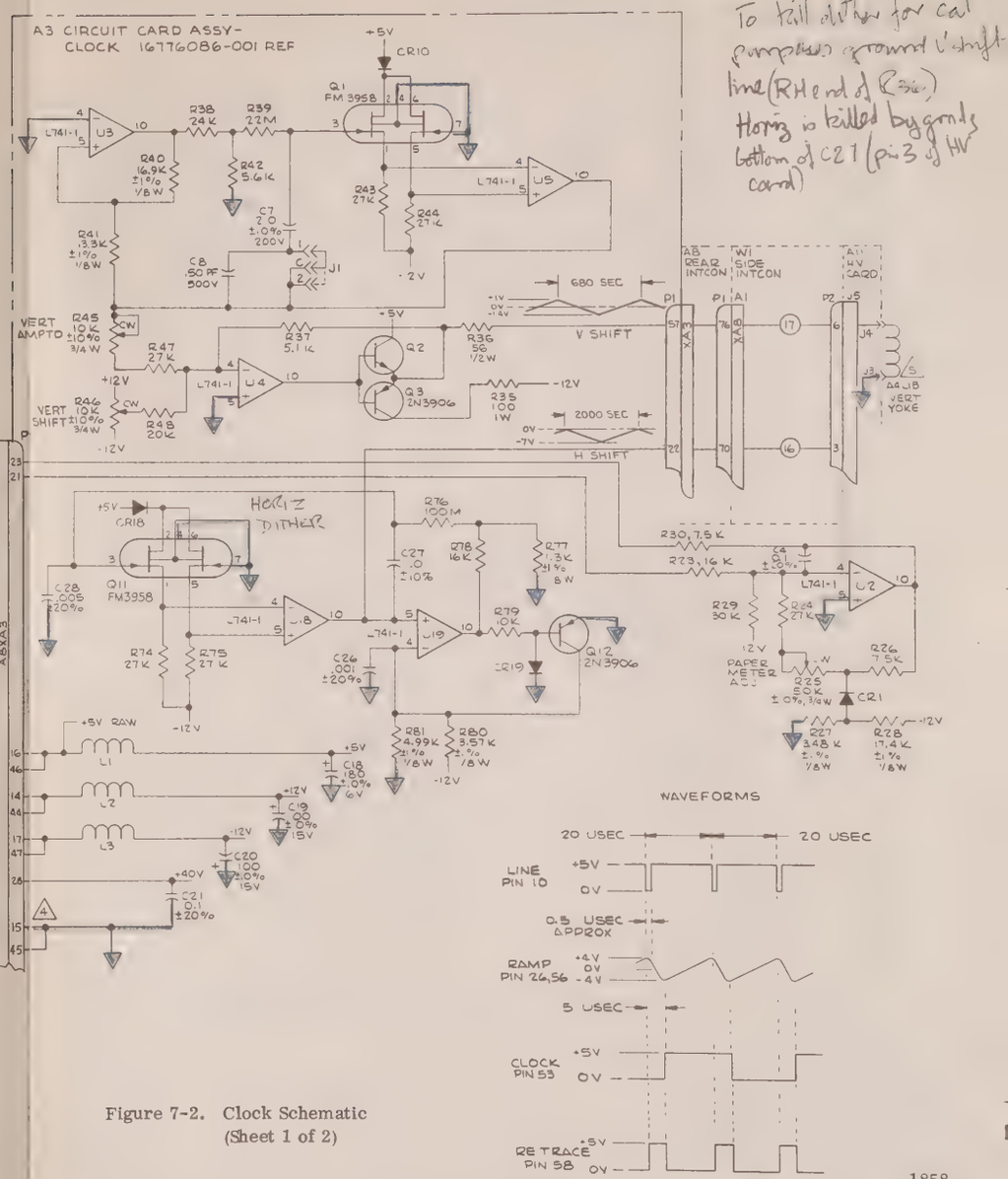
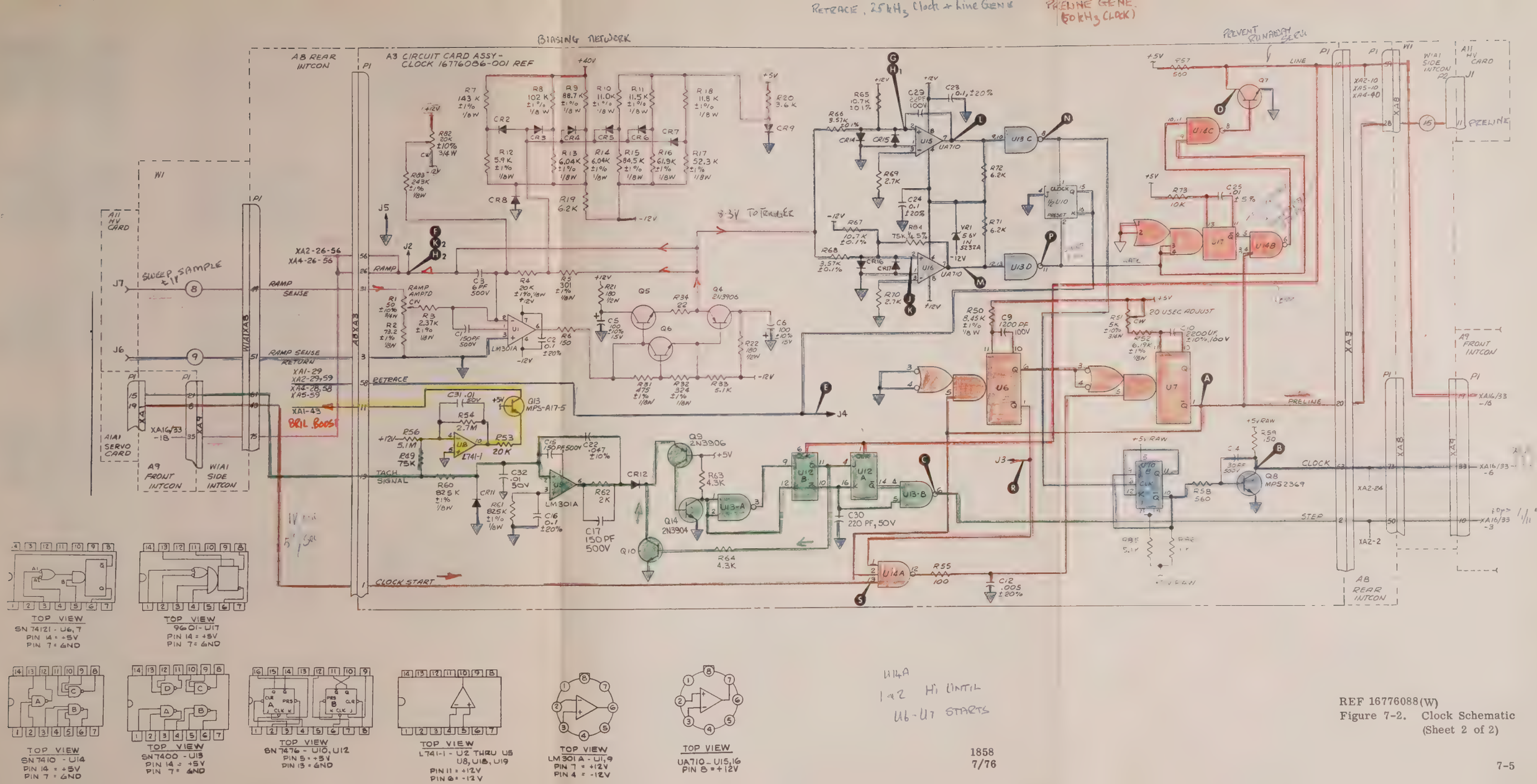


Figure 7-2. Clock Schematic (Sheet 1 of 2)



TOP VIEW
SN 74121 - U6, 7
PIN 14 = +5V
PIN 7 = GND

TOP VIEW
9601 - U17
PIN 14 = +5V
PIN 7 = GND

TOP VIEW
SN 7410 - U14
PIN 14 = +5V
PIN 7 = GND

TOP VIEW
SN 7400 - U13
PIN 14 = +5V
PIN 7 = GND

TOP VIEW
SN 7476 - U10, U12
PIN 5 = +5V
PIN 13 = GND

TOP VIEW
L741-1 - U2 THRU U5
U8, U18, U19
PIN 11 = +12V
PIN 6 = -12V

TOP VIEW
LM 301 A - U1, 9
PIN 7 = +12V
PIN 4 = -12V

TOP VIEW
UA710 - U15, 16
PIN 8 = +12V

REF 16776088(W)
Figure 7-2. Clock Schematic (Sheet 2 of 2)

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 W.
   CAPACITANCE VALUES ARE IN UF, ±20 %, 30 V.
   DIODES ARE IN4148

2. REFERENCE DESIGNATIONS ARE SHOWN FOR REFERENCE ONLY AND DO NOT NECESSARILY APPEAR ON PART.

3. RESISTOR R19 (SEE CIRCUIT 1 AND TABLE I) TO BE 1.2K, ± 5%, 1/4 W.

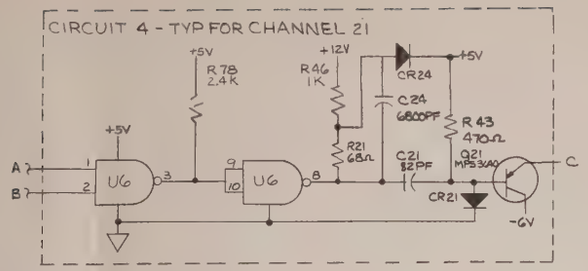
5. INTEGRATED CIRCUIT TYPES ARE AS FOLLOWS:

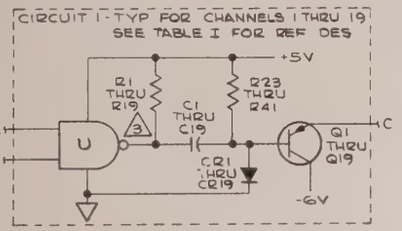
REF DES	U1 THRU U6	U7	U8	U9	U10
TYPE	SN74H01N	SN74H05N	SN74H04N	SN74121N	SN7476N

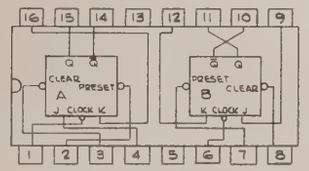
6. ONLY PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH A3.

TABLE I: TABLE OF CORRESPONDING REF DESIGNATIONS FOR CIRCUIT 1

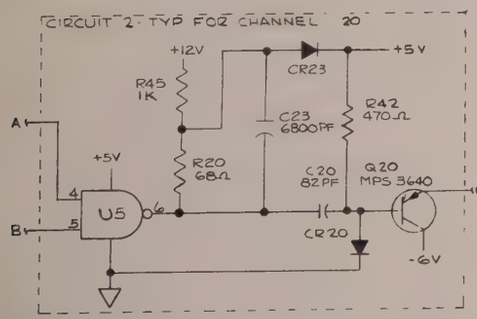
	4.7 K ±5%, 1/4W	470 Ω ±5%, 1/4 W	120 PF ±10% 500V	IN4148	MPS3640	SN74H01N
CHANNEL 7	R7	R29	C7	CR7	Q7	U2, PIN 11,12,13
8	R8	R30	C8	CR8	Q8	U2, PIN 8,9,10
3	R3	R25	C3	CR3	Q3	U1, PIN 11,12,13
4	R4	R26	C4	CR4	Q4	U1, PIN 8,9,10
5	R5	R27	C5	CR5	Q5	U1, PIN 4,5,6
6	R6	R28	C6	CR6	Q6	U1, PIN 1,2,3
1	R1	R23	C1	CR1	Q1	U2, PIN 1,2,3
2	R2	R24	C2	CR2	Q2	U2, PIN 4,5,6
9	R9	R31	C9	CR9	Q9	U3, PIN 11,12,13
10	R10	R32	C10	CR10	Q10	U3, PIN 8,9,10
11	R11	R33	C11	CR11	Q11	U3, PIN 4,5,6
12	R12	R34	C12	CR12	Q12	U3, PIN 1,2,3
13	R13	R35	C13	CR13	Q13	U4, PIN 11,12,13
14	R14	R36	C14	CR14	Q14	U4, PIN 8,9,10
15	R15	R37	C15	CR15	Q15	U4, PIN 4,5,6
16	R16	R38	C16	CR16	Q16	U4, PIN 1,2,3
17	R17	R39	C17	CR17	Q17	U5, PIN 11,12,13
18	R18	R40	C18	CR18	Q18	U5, PIN 8,9,10
CHANNEL 19	③ R19	R41	C19	CR19	Q19	U5, PIN 1,2,3

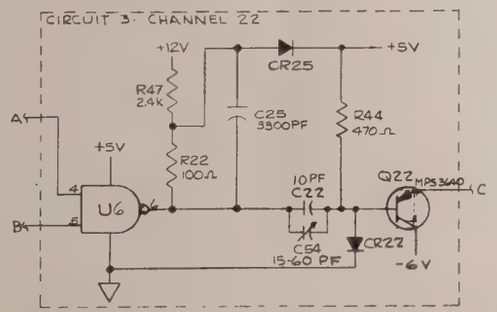


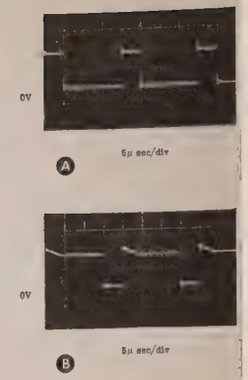


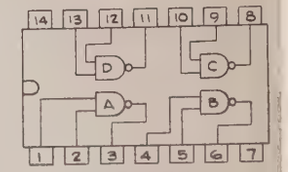


TOP VIEW
SN7476N - U10
PIN 5 = +5V
PIN 13 = GND

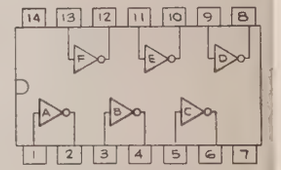




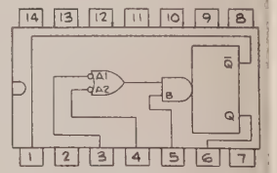




TOP VIEW
SN74H01N - U1 THRU U6
PIN 7 = GND
PIN 14 = +5V



TOP VIEW
SN74H05N - U7
SN74H04N - U8
PIN 7 = GND
PIN 14 = +5V



TOP VIEW
SN74121N - U9
PIN 7 = GND
PIN 14 = +5V

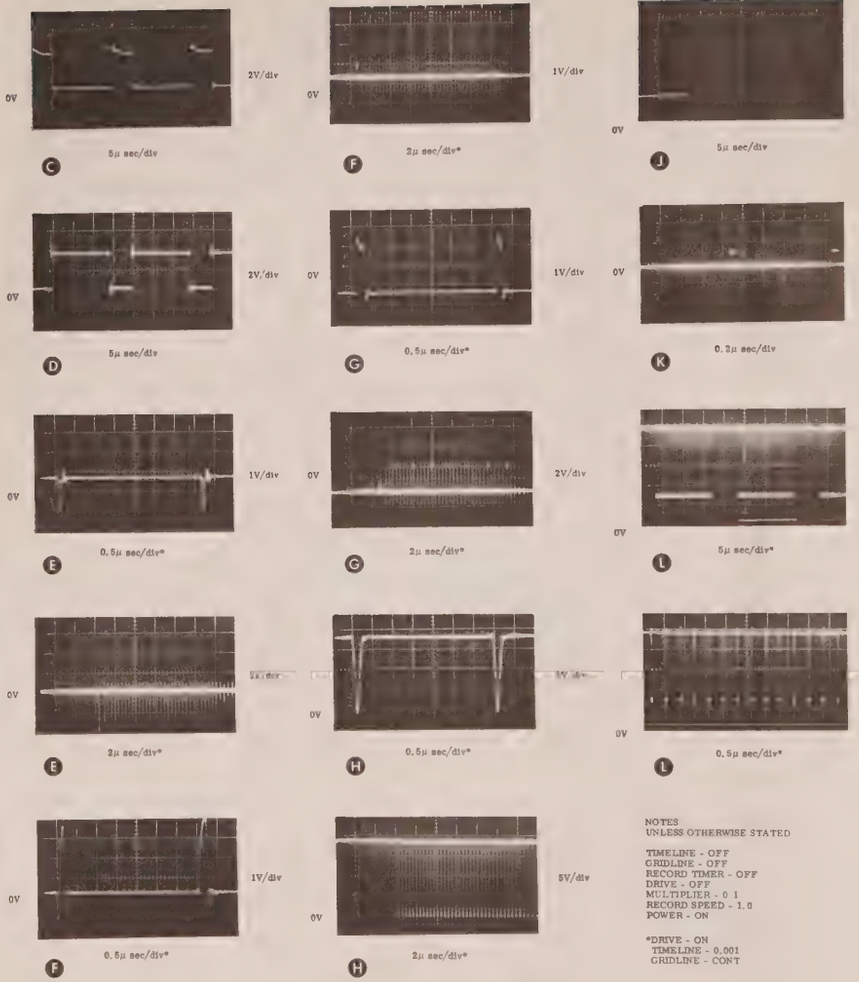
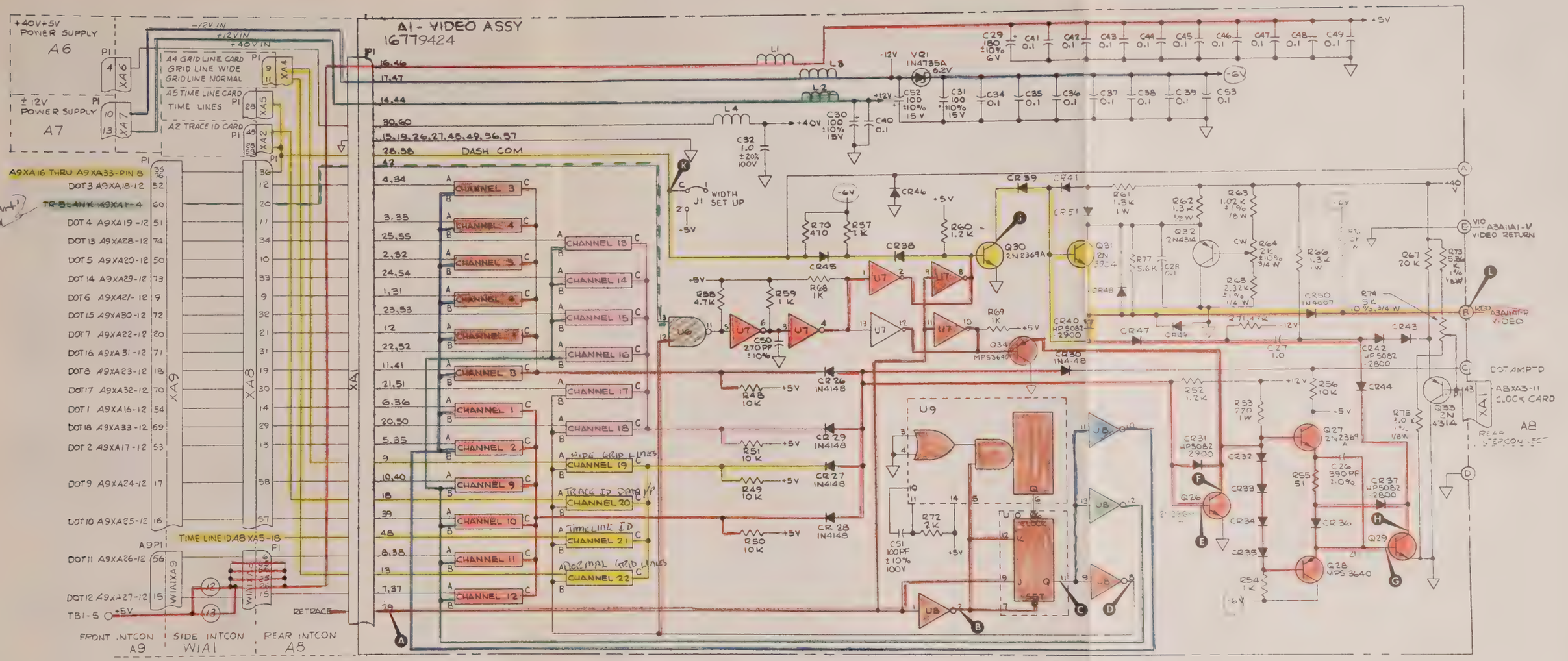
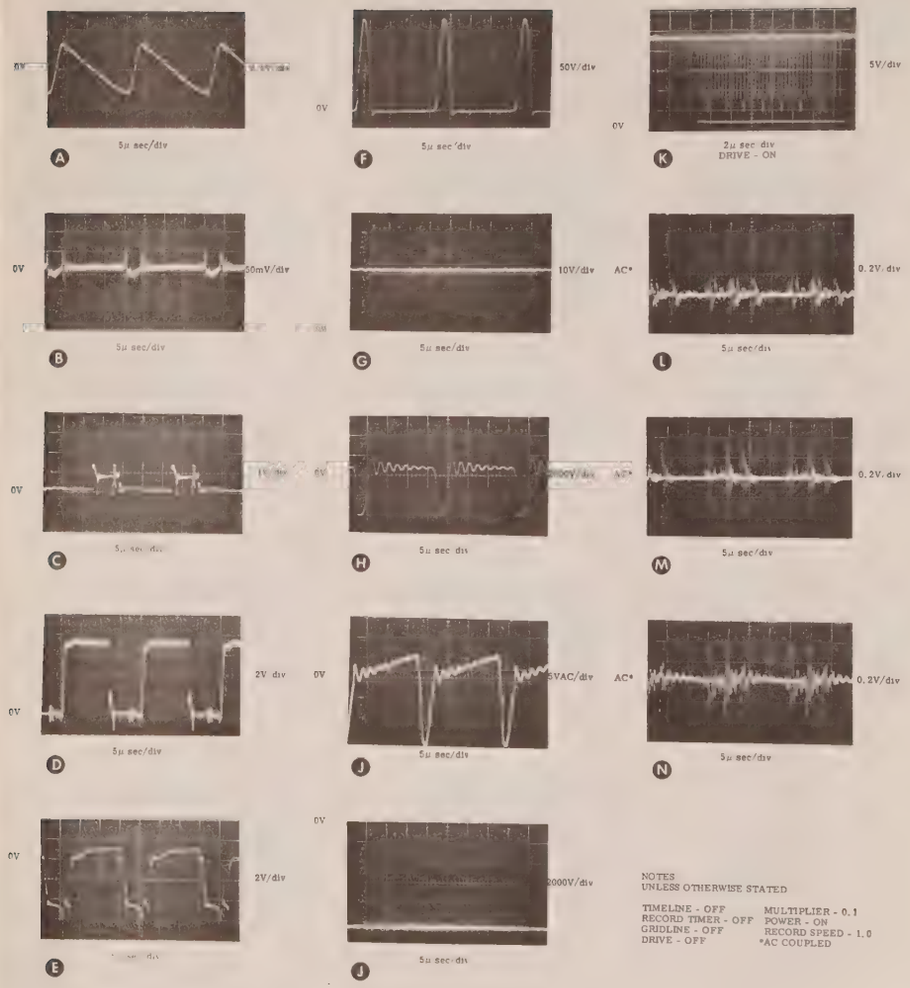


Figure 7-3. Video Amplifier Schematic (Sheet 1 of 2)



REF 16779477-002 (E)
Figure 7-3. Video Amplifier Schematic (Sheet 2 of 2)

1858 Note Inverting Dots on SET &
5/76 CLOCK I/Ps of U10

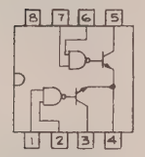


NOTES
UNLESS OTHERWISE STATED

TIMELINE - OFF
RECORD TIMER - OFF
GRIDLINE - OFF
DRIVE - OFF
MULTIPLIER - 0.1
POWER - ON
RECORD SPEED - 1.0
*AC COUPLED

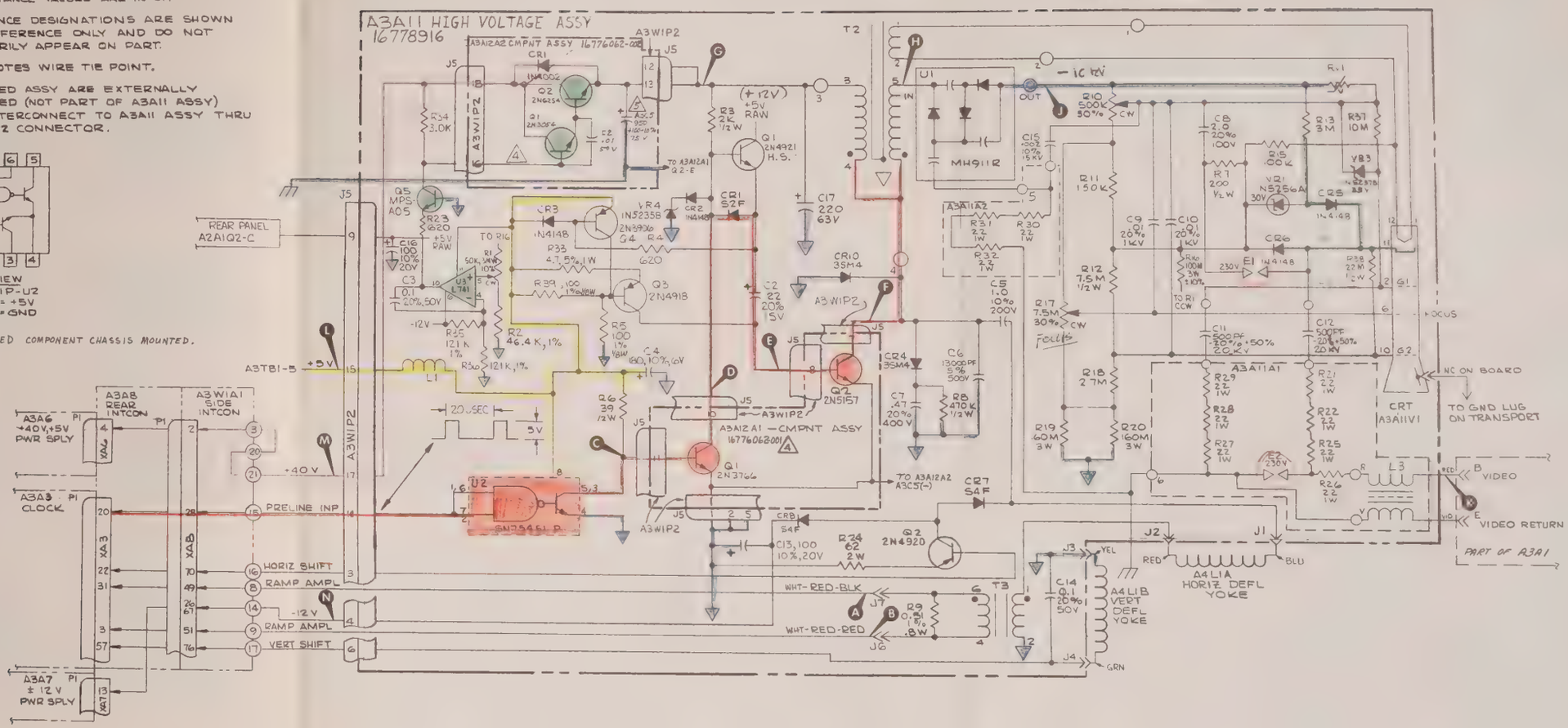
NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, 5%, 1/4 W. CAPACITANCE VALUES ARE IN UF.
2. REFERENCE DESIGNATIONS ARE SHOWN FOR REFERENCE ONLY AND DO NOT NECESSARILY APPEAR ON PART.
3. ○ DENOTES WIRE TIE POINT.
4. INDICATED ASSY ARE EXTERNALLY MOUNTED (NOT PART OF A3A11 ASSY) AND INTERCONNECT TO A3A11 ASSY THRU A3W1P2 CONNECTOR.



TOP VIEW
SN7545IP-U2
PIN 8 = +5V
PIN 4 = GND

5 INDICATED COMPONENT CHASSIS MOUNTED.

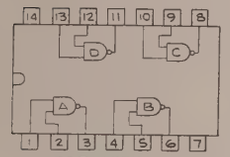


REF 16778940 (A)
Figure 7-4. High Voltage Schematic

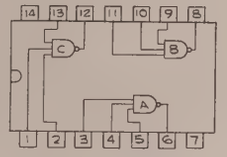
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, ± 1%, 1/4 W.
   CAPACITANCE VALUES ARE IN UF, ±10%, 15V.
   DIODES ARE IN4148.
2. REFERENCE DESIGNATIONS ARE SHOWN FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.
3. ONLY PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH A3.
4. INDICATED DESIGNATIONS ARE COMPLETE.
5. ▭ DENOTES PANEL NOMENCLATURE.
6. PINS 1,2,3,4,5,12,13,18,19,20,21,22,23,24,25,27,29,30,31 32,33,34,35,36,37,38,39,41,42,43,48,49,50,51,52,53 54,55,57,59 AND 60 ARE ALSO GROUND BUT ARE NOT SHOWN.

TOP VIEW
LM-306H-U12
PIN 8 = +12V
PIN 4 = -12V

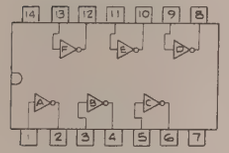


TOP VIEW
SN7400N-U4,6
PIN 14 = +5V
PIN 7 = GND

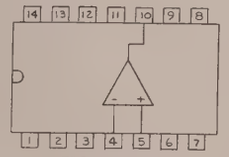


TOP VIEW
SN7410N-U7,14
PIN 14 = +5V
PIN 7 = GND

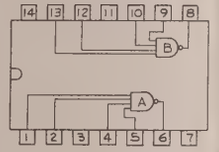
BOTTOM VIEW
CA3039 CR1,2



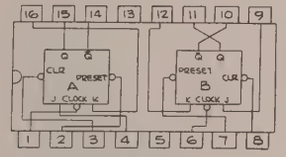
TOP VIEW
SN7404N-U5
PIN 14 = +5V
PIN 7 = GND



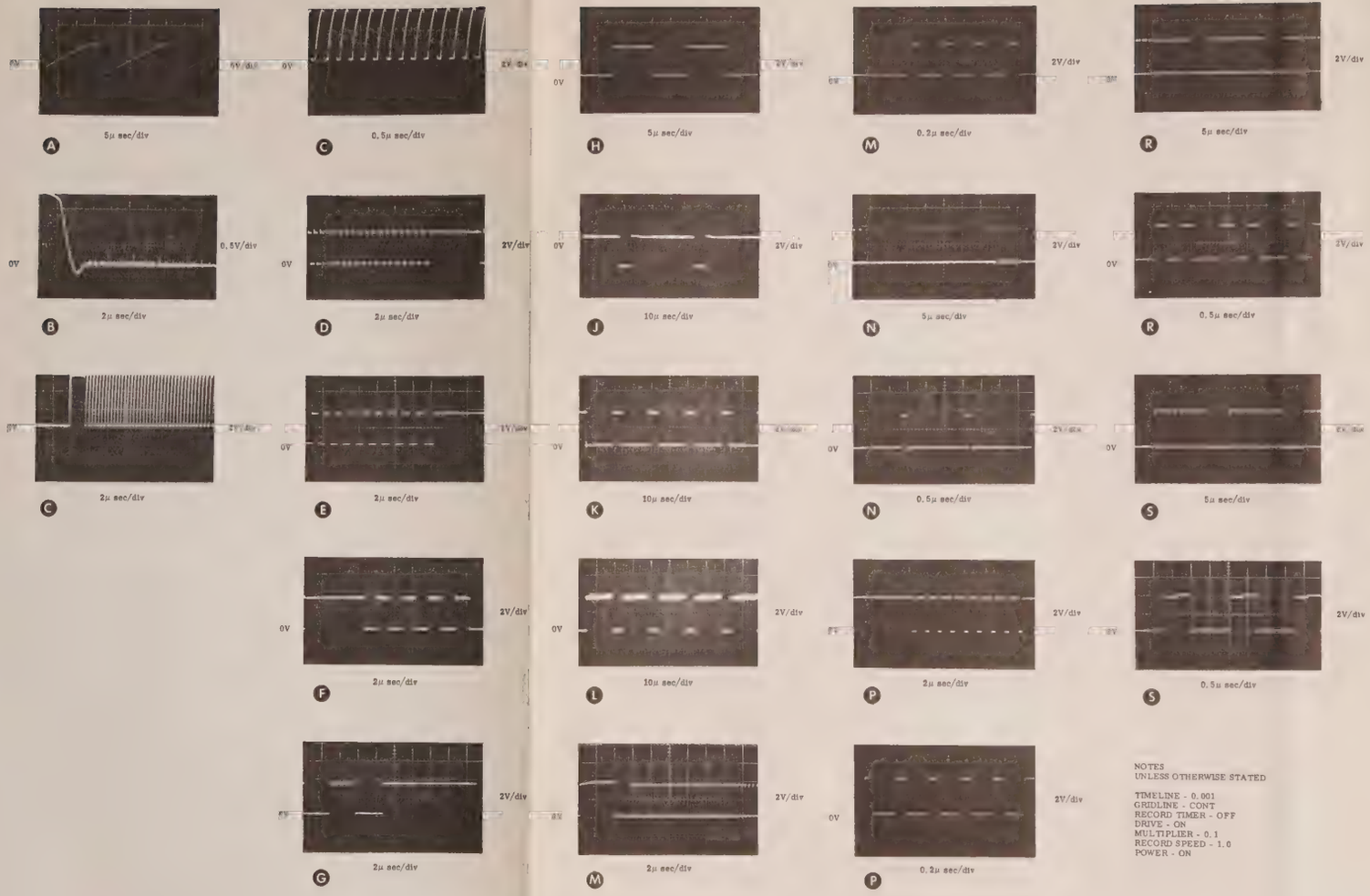
TOP VIEW
L741-1 -U11,13
PIN 11 = +12V
PIN 6 = -12V



TOP VIEW
SN7440N-U8
PIN 14 = +5V
PIN 7 = GND



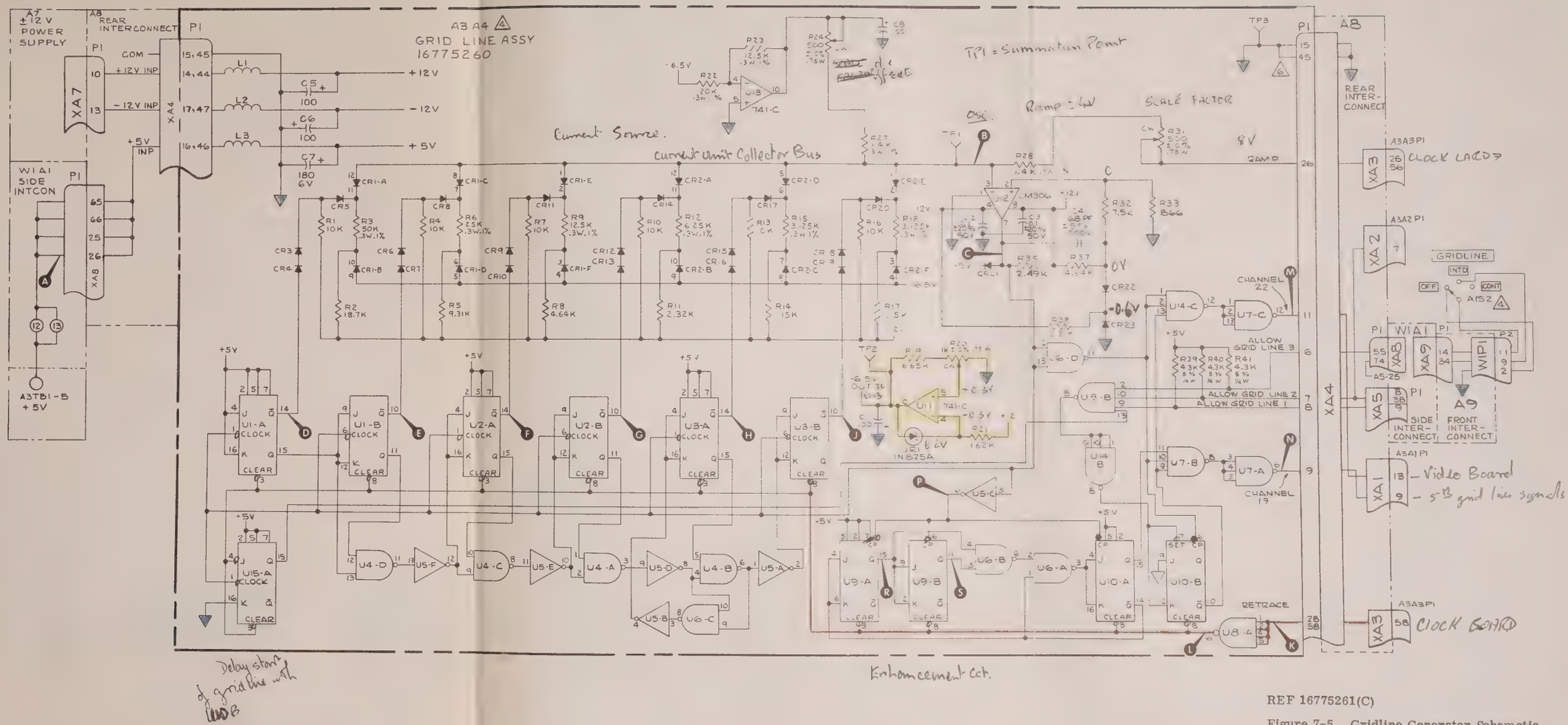
TOP VIEW
SN7476N-U1,2,3,9,10,15
PIN 5 = +5V
PIN 13 = GND



NOTES
UNLESS OTHERWISE STATED

TIMELINE - 0.001
GRIDLINE - CONT
RECORD TIMER - OFF
DRIVE - ON
MULTIPLIER - 0.1
RECORD SPEED - 1.0
POWER - ON

Figure 7-5. Gridline Generator Schematic
(Sheet 1 of 2)



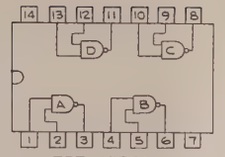
REF 16775261(C)

Figure 7-5. Gridline Generator Schematic (Sheet 2 of 2)

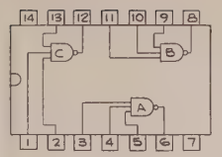
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 W.
   CAPACITANCE VALUES ARE IN UF, ±5%, 500V.
   DIODES ARE IN4148.
   TRANSISTORS ARE 2N3904.
2. REFERENCE DESIGNATIONS ARE SHOWN FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.
3. ONLY PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH A3.
4. INDICATED DESIGNATIONS ARE COMPLETE.
5. ▭ DENOTES PANEL NOMENCLATURE.
6. 11-13, 19-24, 39-43, 48-54, ARE GROUND ALSO.

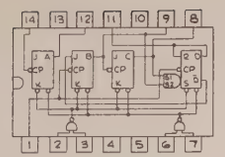
TOP VIEW
LM 301A - U26
PIN 7 = +12V
PIN 4 = -12V



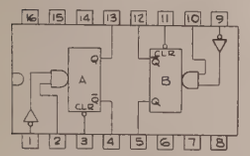
TOP VIEW
SN7400N - U1,2,6,7,11
U12,21,23
PIN 14 = +5V
PIN 7 = GND
SPARE GATES = U6-D, U12-C



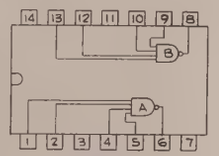
TOP VIEW
SN7410N - U5,9,25
PIN 14 = +5V
PIN 7 = GND
SPARE GATES = U9-C, U25-B



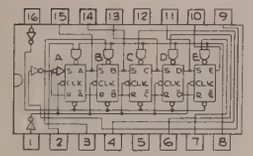
TOP VIEW
SN7490 N - U3,4,8,13
U17,20,22
PIN 5 = +5V
PIN 10 = GND



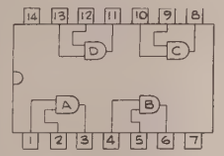
TOP VIEW
SN74123N - U14,19
PIN 16 = +5V
PIN 8 = GND



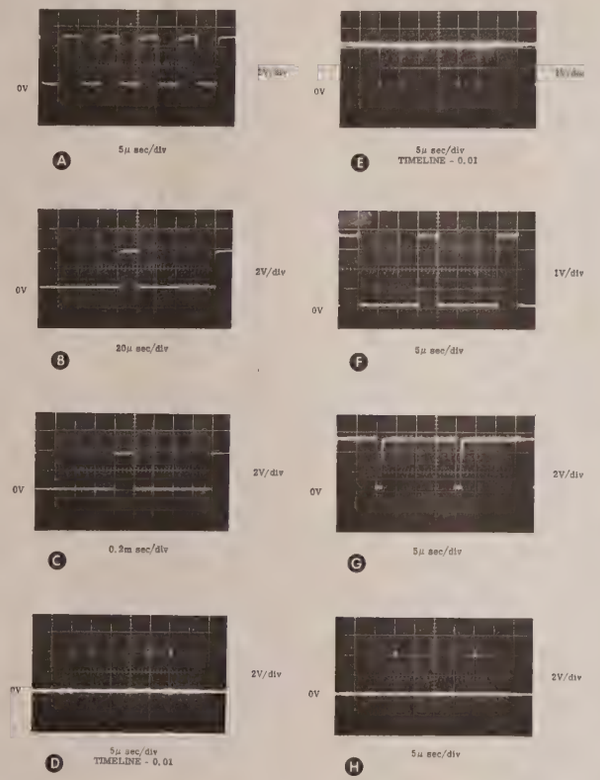
TOP VIEW
SN7440N - U15
PIN 14 = +5V
PIN 7 = GND



TOP VIEW
SN7496N - U10,24
PIN 5 = +5V
PIN 12 = GND



TOP VIEW
SN7408N - U16,18
PIN 14 = +5V
PIN 7 = GND
SPARE GATES = U16-C, U18-C



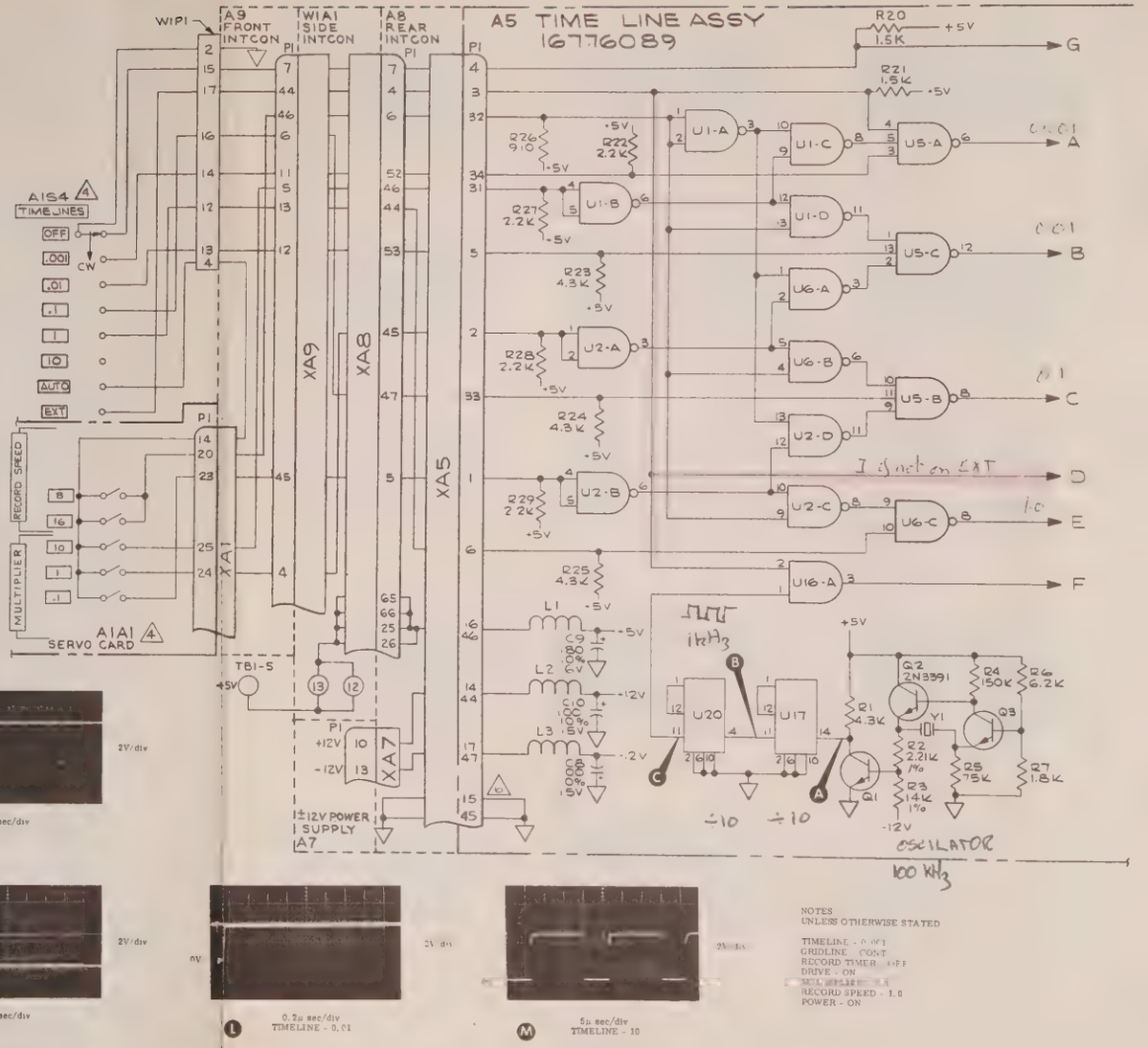
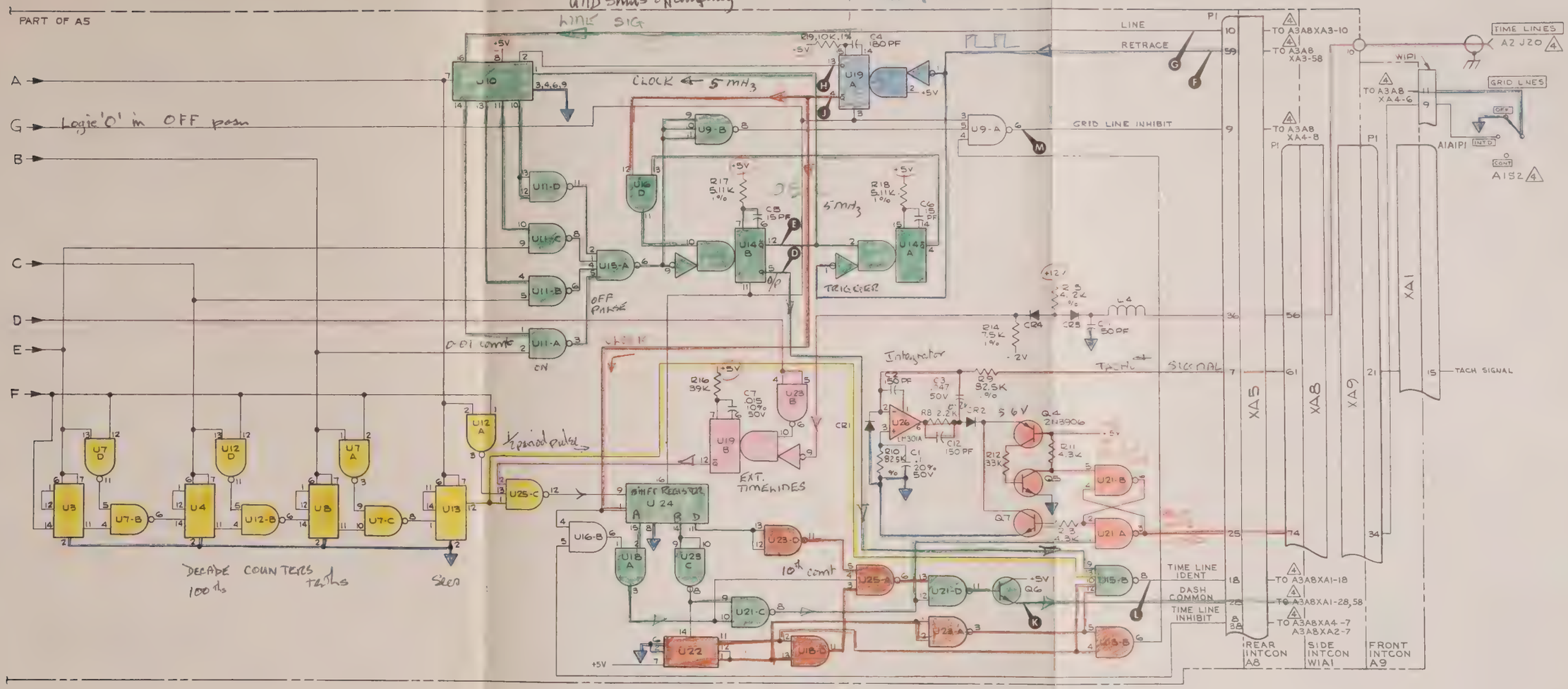


Figure 7-6. Timeline Generator Schematic (Option) (Sheet 1 of 2)

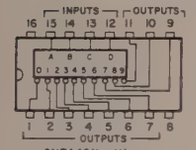


REF 16776090(D)
Figure 7-6. Timeline Generator Schematic (Option) (Sheet 2 of 2)

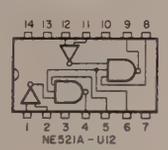
1858
7/76

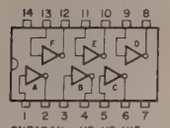
NOTES

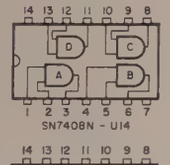
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS, 1/4W, 5%;
   ALL CAPACITANCE VALUES ARE IN UF, 50V, 20%.
2. ▽ DENOTES CIRCUIT COMMON.
3. L1, L2 AND L3 ARE SPECIAL PURCHASE RF CHOKES (SEE PARTS LIST)
4. LIKE LETTERS IN PARENTHESIS ( ) INDICATE COMMON CONNECTIONS ON CIRCUIT CARD.
5. INTEGRATED CIRCUIT PIN IDENTIFICATION IS AS FOLLOWS (TOP VIEW SHOWN):
   UNLESS OTHERWISE SHOWN, ALL INTEGRATED CIRCUITS HAVE PIN 14 CONNECTED TO +5 VDC AND PIN 7 CONNECTED TO GROUND.

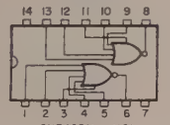


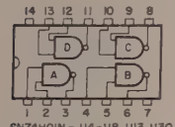
SN7442N - U1
PIN 16 +5V
PIN 8 GND


NE521A - U12

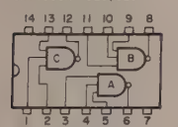

SN7404N - U2, U3, U15

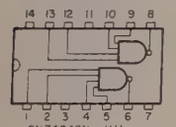

SN7408N - U14

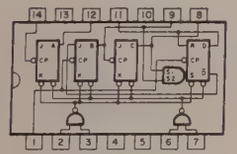

SN7425N - U21

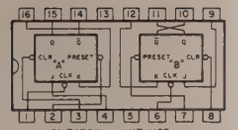

SN74H01N - U4-U8, U13, U30
SN74S00N - U26, U29

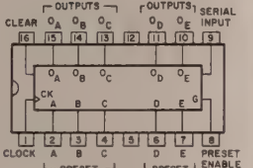
U5B71039X
U28
PIN 8 +12V
PIN 4 -5.8V


SN74I0N - U9, U19
SN74S10N - U10, U27

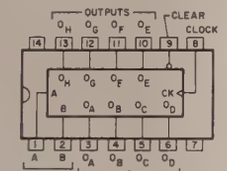

SN74S40N - U11


SN7490N - U16, U22
PIN 5 +5V
PIN 10 GND

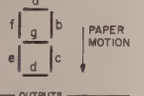

SN7476N - U17, U23
PIN 5 +5V
PIN 13 GND

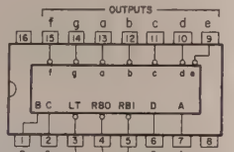


SN7496N - U18
PIN 5 +5V
PIN 12 GND



SN74164N - U20





SN7447AN - U24, U25
PIN 16 +5V
PIN 8 GND

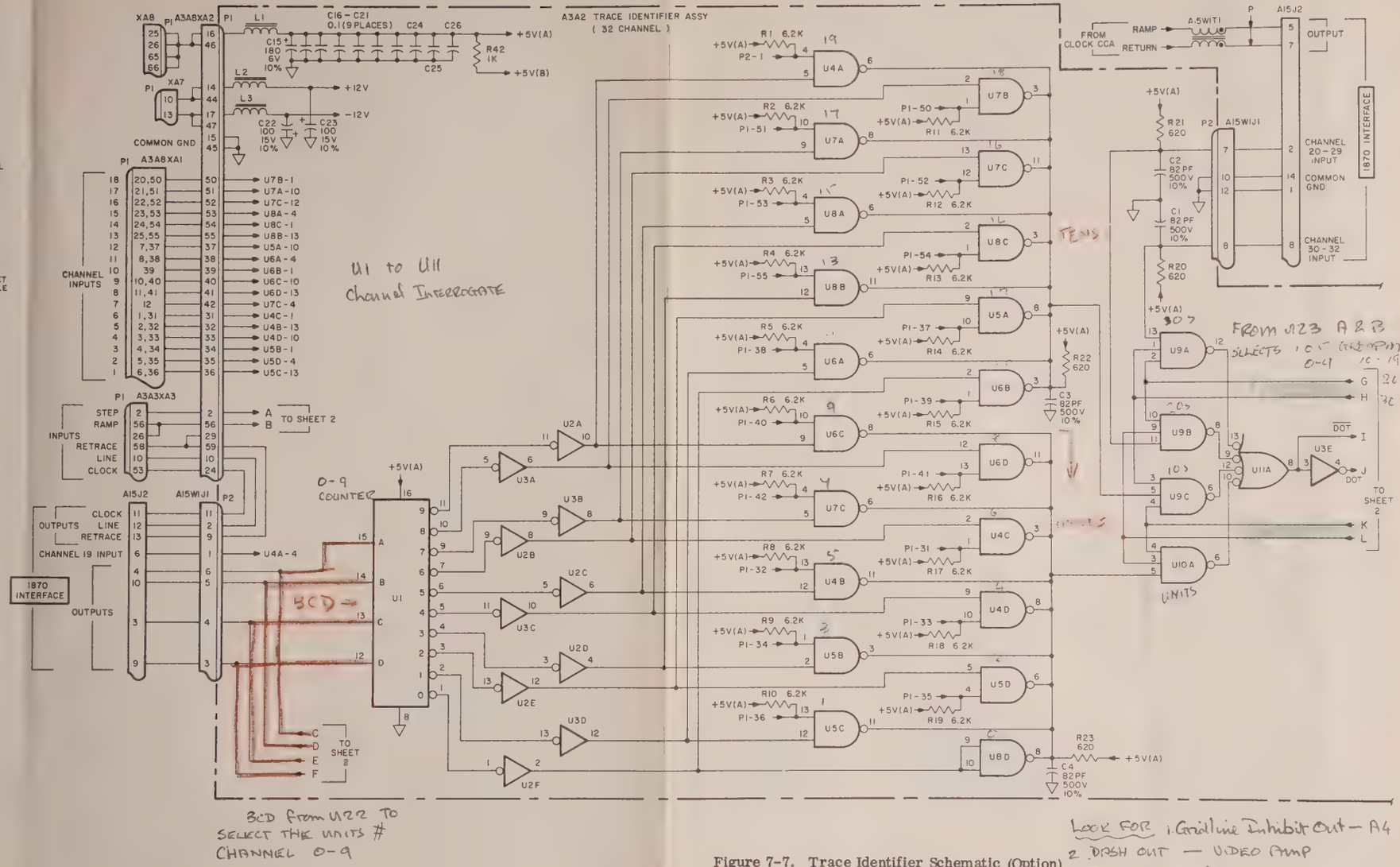


Figure 7-7. Trace Identifier Schematic (Option) (Sheet 1 of 2)

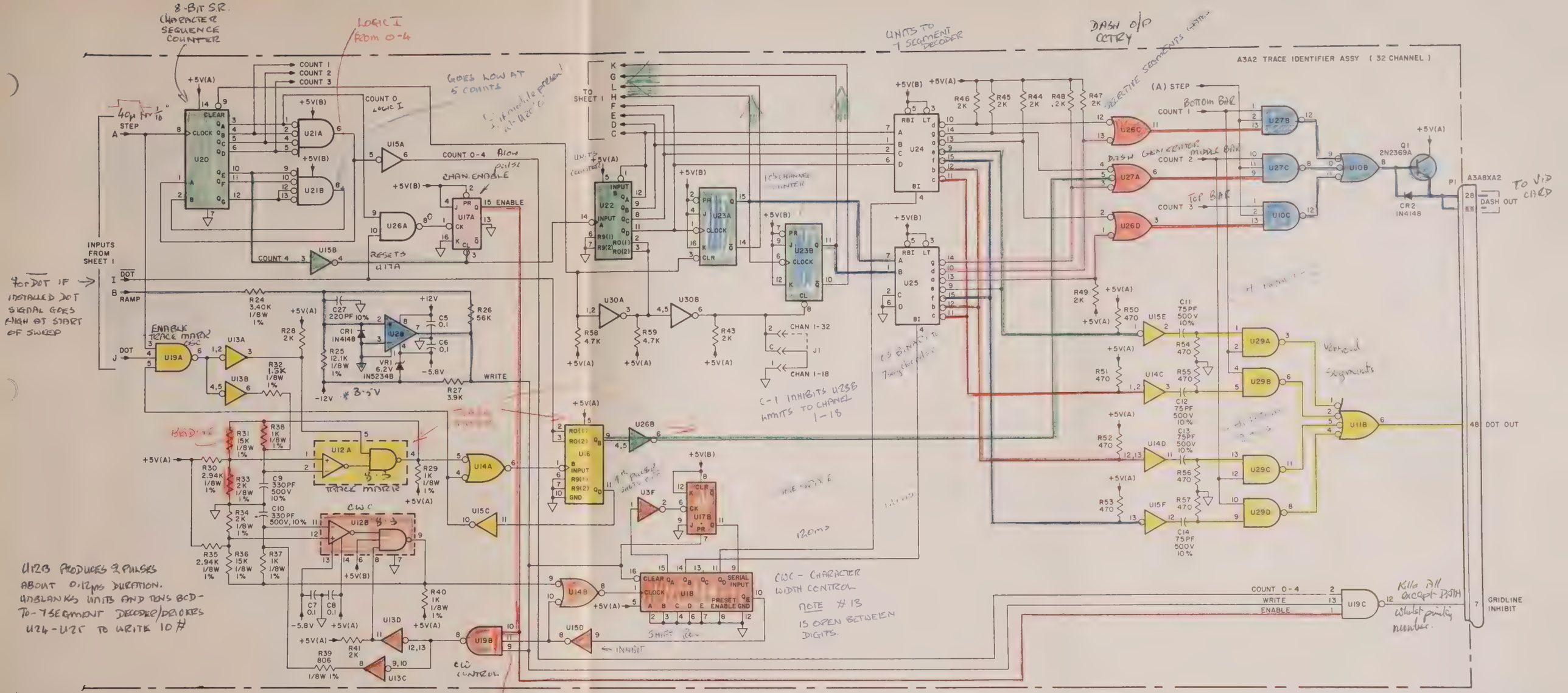


Figure 7-7. Trace Identifier Schematic (Option) (Sheet 2 of 2)

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE VALUES ARE IN OHMS, ±1%, 1/4 W.

   CAPACITANCE VALUES ARE IN UF, ±20%, 50 V.

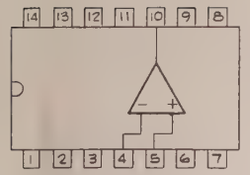
   DIODES ARE IN4148.

   ZENER DIODES ARE IN5234B, 6.2V.

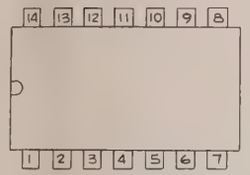
2. ONLY PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, DESIGNATION, PREFIX WITH A3, EXCEPT AS NOTED.

3. INDICATED REFERENCE DESIGNATIONS ARE COMPLETE DESIGNATIONS.

4. ○ INDICATES WIRE TIE POINT ON CIRCUIT CARD ASSY

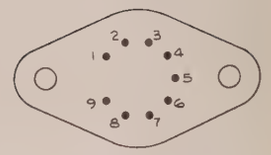


TOP VIEW
L741
A6U3
A7U3, U4
PIN 7 = GND
PIN 11 = +Vcc
PIN 6 = -Vcc
PIN 4 = INVERTING INPUT
PIN 5 = NON-INVERTING INPUT
PIN 3, PIN 9 = OFFSET NULL
PIN 10 = OUTPUT



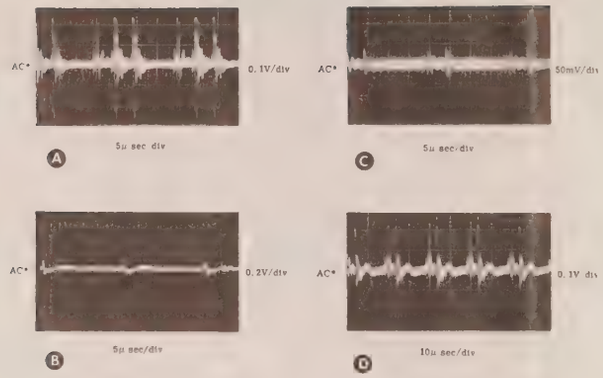
TOP VIEW
MC1466L A6U1

PIN 1 =
PIN 2 = CURRENT SET
PIN 3 = CURRENT SOURCE
PIN 4 = CURRENT SET
PIN 5 = OUTPUT
PIN 6 = COMPENSATION
PIN 7 = -VAUX
PIN 8 = VOLTAGE SENSE INPUT
PIN 9 = VOLTAGE SENSE INPUT
PIN 10 = CURRENT SENSE INPUT
PIN 11 = CURRENT SENSE INPUT
PIN 12 = INTERNAL REGULATED VOLTAGE
PIN 13 = INTERNAL COMPENSATION
PIN 14 = +VAUX



BOTTOM VIEW
MC1463R, A7U2
PIN 1 = DC SHIFT SENSE
PIN 2 = SHUT DOWN CONTROL
PIN 3 = NOISE FILTER
PIN 4 = VIN
PIN 5 = CURRENT LIMIT
PIN 6 = VOUT
PIN 7 = COMPENSATION
PIN 8 = OUTPUT SENSE
PIN 9 = DC SHIFT OUTPUT
CASE = GROUND

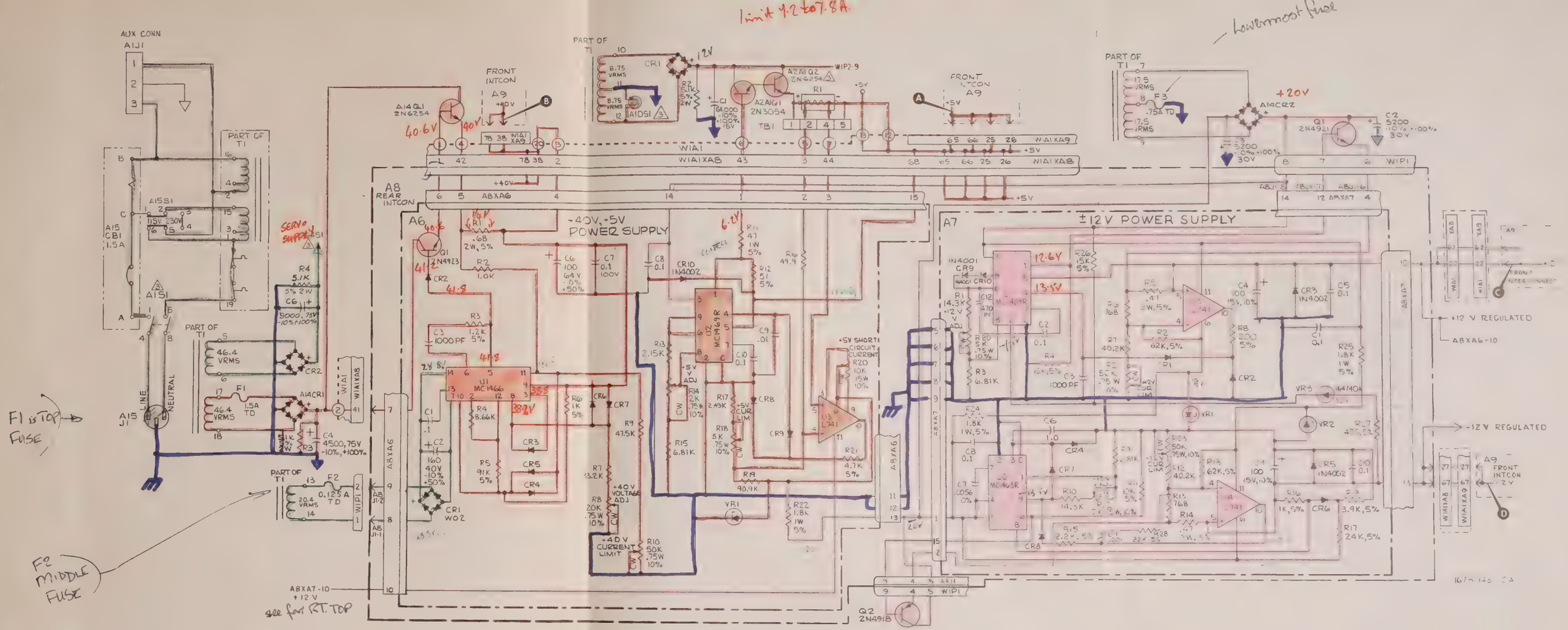
MC1469R, A6U2, A7U1
SAME OUTLINE AND PIN DESIGNATIONS AS MC1463R, EXCEPT FOR FOLLOWING PIN NOMENCLATURE:
PIN 1 = OUTPUT
PIN 2 = SHUTDOWN CONTROL
PIN 3 = +VIN
PIN 4 = COMPENSATION AND CURRENT LIMIT
PIN 5 = OUTPUT SENSE
PIN 6 = OUTPUT REFERENCE
PIN 7 = NOISE FILTER
PIN 8 = DC SHIFT SENSE
PIN 9 = DC SHIFT OUTPUT
CASE = GROUND



NOTES
UNLESS OTHERWISE STATED
*AC COUPLED

16781143-1A

Figure 7-8. Power Supply Schematic
(Sheet 1 of 2)



REF 16781143(B)
Figure 7-8. Power Supply Schematic (Sheet 2 of 2)

www.manualsplus.com
1036110